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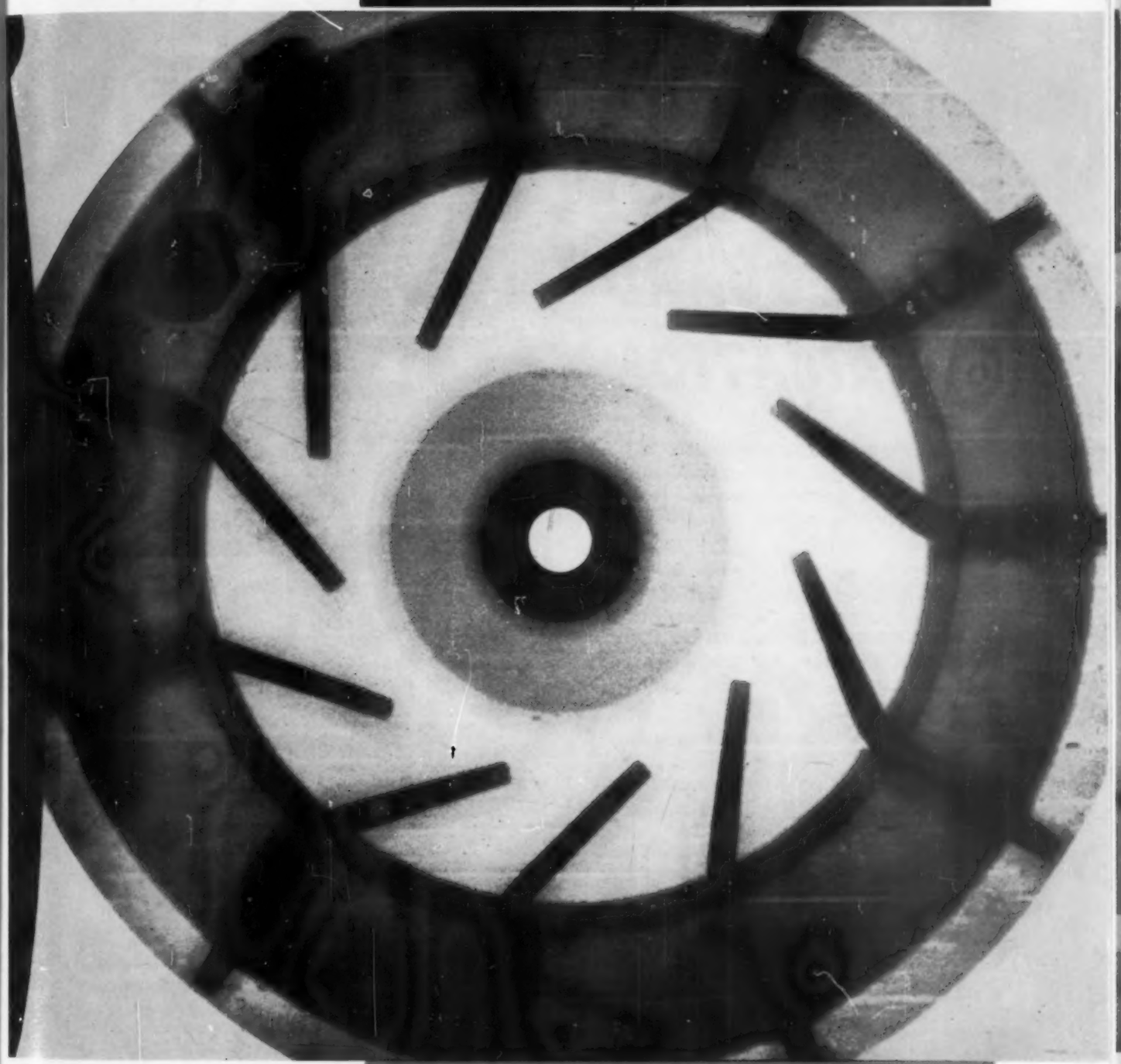

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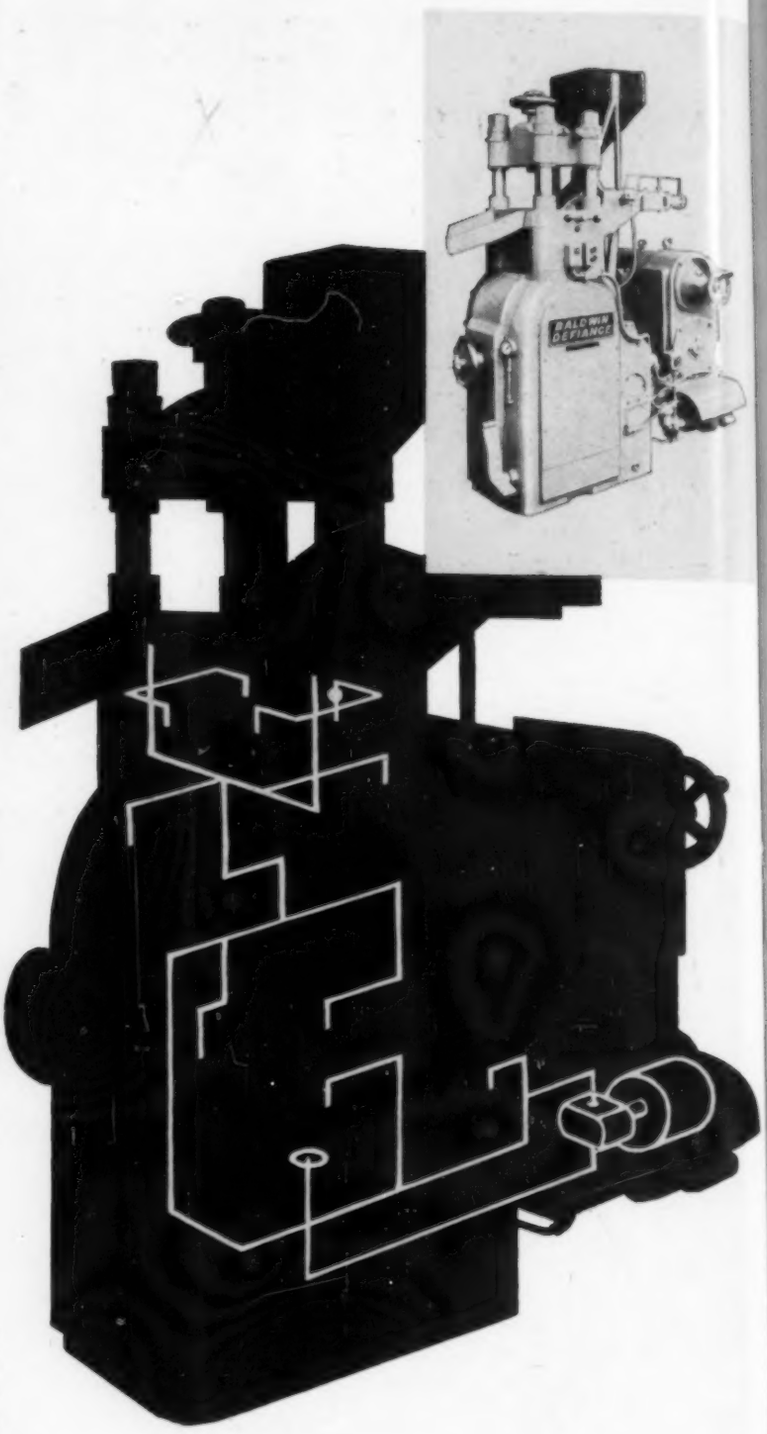
X-RAY AND FLUOROSCOPIC INSPECTION OF PLASTIC PARTS

an article by J. A. Newmann and F. J. Bockhoff/page 87

BALDWIN plastics presses reduce downtime with *SAFEGUARD LUBRICATION*



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MARCH 1955

VOLUME 1, NUMBER 2

WEATHERING PROPERTIES OF VINYL PLASTICS ..... J. G. Hendricks 81
Weathering properties depend on an understanding and proper balancing of resins, compounding ingredients, and other factors.

THE INJECTION MACHINE PICTURE ..... A. R. Morse 86
A GUEST EDITORIAL

X-RAY INSPECTION METHODS IN PLASTICS FABRICATION
J. A. Neumann and F. J. Bockhoff 87
X-ray and fluoroscopic methods provide for rapid, non-destructive inspection of fabricated parts to maintain quality standards.

PRECISION CONTROL OF INJECTION MOLDING PRESSURE Gordon B. Thayer 91
Two major problems in achieving precision control of injection molding pressure are discussed and solutions suggested.

ISOCYANATES—THEIR FORMATION, REACTIONS, AND APPLICATIONS
R. D. Hirschbeck 95
A discussion of the chemical fundamentals needed for an understanding of these remarkable new materials.

FEATURE DEPARTMENTS

Letters to the Editor	72	New Materials	110
News in Brief	77	New Equipment	114
Editorial	79	New Products	116
News of the Societies	100	Book Reviews	118
Calendar of Coming Events	133	New Literature	119
News of the Industry	102	Abstracts of Important Articles	120
News from Abroad	108	Patent Digest	126
Names in the News	109	Resins: Production and Sales	130
Obituaries	—	Current Market Prices	125

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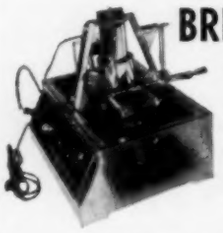

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Volume 1, Number 1 of PLASTICS TECHNOLOGY is an excellent job. I like your editorial formula and feel that you will do well if you can continue at this level. Our very best wishes.

J. H. DuBois
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Just received my copy of PLASTICS TECHNOLOGY, and I want to congratulate you on an extremely fine job. I believe that PLASTICS TECHNOLOGY is a valuable addition to the plastics literature, and wish you every success.

Jesse H. Day, Editor
"SPE Journal"
Athens, Ohio

Best of luck in this new enterprise.

Raymond B. Seymour, President
Atlas Mineral Products Company
Mertztown, Pennsylvania

I have just examined the first issue of PLASTICS TECHNOLOGY, and want to congratulate you and your publishers for an excellent "first edition."

Robert R. Moore
Eastman Chemical Products, Inc.
New York, New York

We wish to acknowledge receipt of the first issue of PLASTICS TECHNOLOGY, and want to congratulate you on the wonderful job you have done. Arnkurt Associate Engineers, as engineers to the plastics industry, find your magazine both enlightening and refreshing. We feel the plastics industry will attain through you a valuable source of technical information. In every respect, we feel your magazine will become the leading technical plastics publication. We are looking forward to your future editions. Best wishes for your continued success.

Curtis F. Pearl, President
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New York, New York

Yesterday, we received our copy of the first issue of PLASTICS TECHNOLOGY and wish to commend you on the excellent content and make-up of this new publication. At this time, we want to enter one-year subscriptions for our branch offices.

G. W. McIntyre, Jr.
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We have just received the first issue of PLASTICS TECHNOLOGY. We find it very interesting, and look forward to enjoying reading it in the future.

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Cadillac Plastic Company
Detroit, Michigan

Congratulations on your new magazine, PLASTICS TECHNOLOGY. We expect that this magazine will fill a definite need in this field.

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Chicago, Illinois

I very much enjoyed reading the first issue of your magazine. I have written to various members of your Editorial Advisory Board wishing them success and offering any assistance that I might be able to give.

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I want to congratulate you on the excellence of the first issue of PLASTICS TECHNOLOGY, and to tell you how pleased I am to be associated with such an outstanding publication.

John H. Woodruff, Vice President
Auburn Button Works, Incorporated
Auburn, New York

We wish PLASTICS TECHNOLOGY every success.

John J. Keville, Jr.
Assistant General Sales Manager
Celanese Corporation of America
Newark, New Jersey

NEWS in BRIEF

New Sales Service Laboratory for DuPont Polychemicals was officially unveiled last month. The modern $3 million installation will handle customer service and development work on plastics, and will aim at educating users on sound engineering and design practices for plastics.

New polyethylene producing plants are in the news again. Test run production of Poly-Eth was recently completed by Spencer Chemical at its new Orange, Tex., plant. Trial operation was reported at 80% of designed capacity, and several grades of material were made.

Carbide & Carbon Chemicals began full-scale production of polyethylene, butadiene, and ethylene oxide at its new plant in Seadrift, Tex. The facility has a rated capacity of 60 million pounds of polyethylene annually, and is expected to increase the industry's production of this material by more than 25%.

Full production of the resin this summer is expected by Dow Chemical at its new Freeport, Tex., plant. Evaluation samples of molding and extrusion compounds are already being supplied by the company.

Visking opened its new Visqueen polyethylene film plant at Flemington, N. J. The million-dollar installation is a link in the company's projected coast-to-coast operation.

Injection molding industry may be affected by recent sales of the three major injection machine manufacturers, says IMS president Morse. New ownerships of these firms may well portend vital changes in equipment and policies, as well as personnel. Changes in policies on machine guarantees and repair parts, and an insufficient understanding of the cyclical nature of the business, could affect the molders and the entire injection molding industry. (See guest editorial, page 86.)

Epidemic of company mergers and purchasers continues. Merger of Hooker Electrochemical and Durez is under way. Durez is expected to retain its name and be operated as a division of Hooker which will now have two irons (phenolics and polyesters) in the resin pot.

A stock exchange is in the works between Michigan Molded Plastics and St. Regis Paper. The chemical division of Emulsol has become a division of Witco Chemical. Scrap dealer A. Bamberger and affiliate American Molding Powder were purchased by Eisenstein of Ansbacher-Siegle and the Federal Color Labs.

A new radiation research laboratory is being constructed by Diamond Alkali at its Painesville, O., research center. The lab will investigate the possibility of harnessing gamma rays for polymerization and other chemical reaction applications.

Design engineering is the theme of a new industrial exposition scheduled for Philadelphia, Pa., May 31-June 3. Successor to the Basic Materials Expositions, the new show will aim at helping design engineers reduce manufacturing costs and improve products.

New materials of interest (see page 111) include syntactic foams; a glass-reinforced phenolic resin; rigid PVC sheets; a heat-stable blue pigment; a fluorine polymer; styrene-rubber blended sheets; styrene-type formable sheets; a new saran resin; vinyl cements; a rigid polyethylene; two silica fillers; and new phthalate plasticizers.

News in equipment (see page 114) covers a high-frequency heating unit; tension-controlling backstands; a two-stage scrap grinder; a rotary blender; diamond-surfaced steel saws; an injection machine; an abrasive disc grinder; and automatic compression presses.

New products (see page 116): a window track; battery servicer unit; Teflon spray nozzles; rigid vinyl table tops and playing cards; vinyl foam cushioning; glass-reinforced building panels; vinyl-based art pigments; and "breathable" vinyl sheeting.

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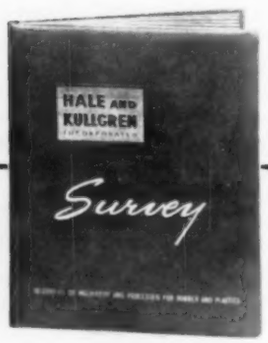


Program for Profits

PLASTICS TECHNOLOGY

MARCH, 1955

EDITORIAL: The Engineering Challenge to Plastics

Plastics are now well on their way towards becoming true materials of engineering. More and more engineering data is becoming available, and the industry is heading toward a classification as a science or technology. Concurrently, it is outgrowing the stage where every item of information was an "art" and a secret to be kept inviolate.

This "art" phase is one that every new industry must pass through. It has some value as an adolescent stage of development, but must be outgrown to achieve true maturity.

The plastics industry is now in the intermediate stage between adolescence and maturity. The stage is set for continued advancement, and the need for this growth is recognized by everyone concerned with the welfare of the industry. Now, what can be done by the industry itself to help?

•

The first responsibility is that of the plastic materials manufacturers. The nature of the industry is such that the processors and fabricators, while numerous, are individually too small to assume the burden of engineering research on materials. This phase of the work has fallen to a large extent on the materials suppliers who have the facilities.

A glance at any metals textbook will reveal the wealth of knowledge, both basic and applied, that is available on each metal. Of course, this information was gathered over many years, but similar data is needed on each plastic material, and as quickly as possible.

Fundamental knowledge of the chemical behavior of plastics is needed, and work on this aspect has been in progress from the start. Also under way is work to obtain the necessary basic information on processing principles and techiques. But only in the past few years has this work been conducted in planned scientific programs designed to give correlating results.

•

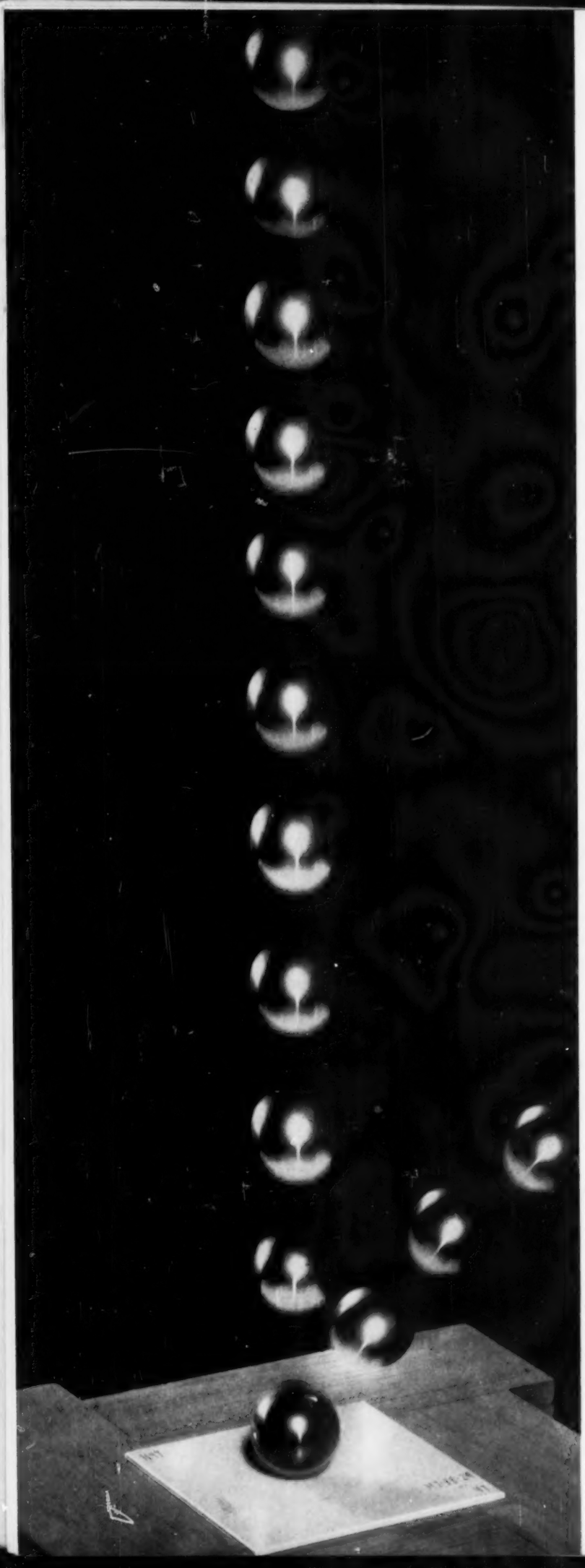
As yet, plastics property data for design and application engineers is still far from adequate. It is true that each materials manufacturer furnishes some property data on his products, but a real engineering casebook for each material is still not available.

To illustrate, each supplier gives a tensile figure for his material. In some cases, he may even give one or more additional figures for non-room temperatures. But the designer must have complete tensile data over the entire temperature service range of the material.

There are no good or bad physical properties, only true or false figures. A property good for one application may be entirely unsuitable for another, yet the material is still the same. Complete property data must be made available for each material to ensure proper application. Failure to do so leads to suspicion by potential users of plastics, and service failures of plastic parts that reflect back on the entire industry. The challenge to plastics is clear.

Arthur M. Merrill

Editor



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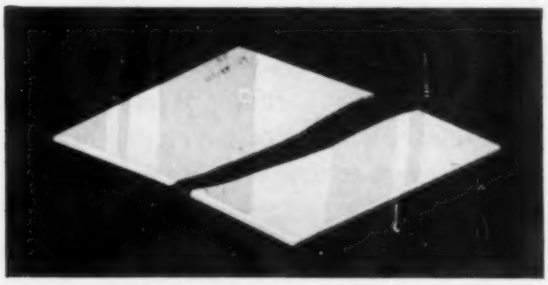

The same steel ball that left sample of Lustrex Hi-Test 88 undamaged (see left) split sample of general purpose styrene (above) when dropped from half the height.

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Howill Studio

John G. Hendricks received a B.S. in chemical engineering from Northeastern University in 1943, and a master's degree in chemistry from Polytechnic Institute of Brooklyn in 1954. He was a chemist for Avon Sole Co. from 1940-1942; a research associate at M.I.T. from 1942-1943; and has held his present position with National Lead since 1943.

Mr. Hendricks holds a number of patents on vinyl-stabilizers and rubber reinforcing agents, and has published many papers in the fields of rubber and plastics. He is active in SPI, ASTM, ACS, and various local technical groups. In his present position, he heads up sales service and new materials development work on products for use in plastics and rubber.

Weathering Properties of Vinyl Plastics

Weathering properties depend on an understanding and proper balancing of resins, compounding ingredients, and other factors.

J. G. HENDRICKS, *Manager*
Rubber and Plastics Laboratory
National Lead Co., Brooklyn, N. Y.

Weathering involves considerably more than exposure to sunlight and occasional rain. Only rarely can optimum practical weathering resistance be achieved by the simple addition of a light stabilizer to a standard formation. The effects of seasonal extremes of temperature and the daily vagaries of humidity and vapor pressure are also critical factors in weathering. The extent of the influence of these factors is controlled by the formulation of the plastic.

A study of weathering properties, therefore, must be integrated with a study of general properties of the plastic to have significance. Fundamentally, the weathering resistance of vinyl plastics is determined by all components of the plastics.

Effect of Resin Selection

The definitive basis for a vinyl plastic is the vinyl resin itself. Recent developments in this field have been remarkable. The standard homopolymer and copolymer resins have been supplemented by paste resins, rigid resins and, most recently, by resins designed for processing over a broad range of temperatures. Concurrently, noticeable improvement has been made in the quality of the "standard resins," especially in the control of molecular weight range and distribution.

The various resins differ, not only in their processing characteristics, but also in their stability characteristics. Figure 1 illustrates the marked difference in heat stability of homopolymer and copolymer resins with barium-cadium-organic type stabilization. This difference is not typical of the relative heat stabilities of these resins, but indicative of differences that can arise in examining the effect of different stabilizers, plasticizers, and other essential compounding materials. Generalizations concerning the effect of different components are very helpful, but resins, even resins of a "temperature series," differ sufficiently in reactivity, compatibility, and the like to make verification of the general rule highly desirable in any specific case.

The effect of resin selection on weathering resistance can be very pronounced, depending on the stabilizer system used in the comparison. Paste and copolymer resins are usually considerably inferior to homopolymer resins in weathering unless effective light stabilizers are used. Table 1 shows that when efficient stabilization is employed, the influence of resin selection on weathering is minimized.

It has been generally accepted that higher processing temperatures detract from weathering resistance. There is no doubt that this effect can and does occur. Nevertheless, processing temperatures must be higher than normally considered necessary for complete fusion of the resin in order to obtain optimum weathering and mechanical properties, as shown in Figure 2. Decreased spewing and tack development, and improved tear resistance parallel the improved weathering and increased modulus obtained at the higher processing temperatures. This effect is less pronounced in well stabilized systems.

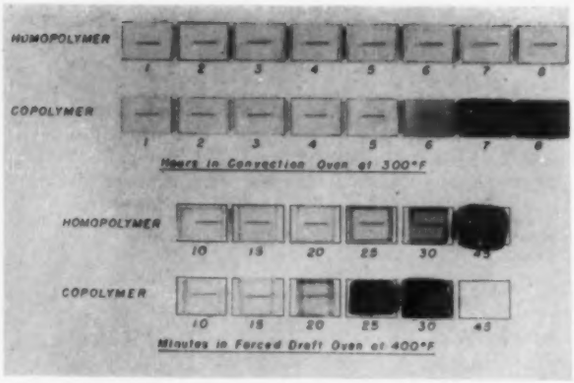

Fig. 1. Effect of vinyl resin type on heat stability of compound with barium-cadmium-organic stabilization.

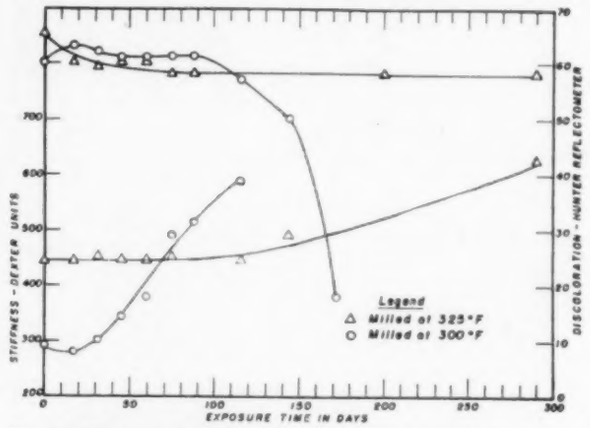

Fig. 2. Effect of processing temperature on weathering.

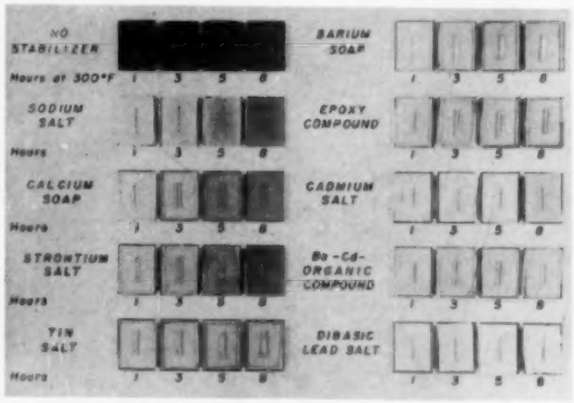

Fig. 3. Effect of stabilizer type on heat stability.

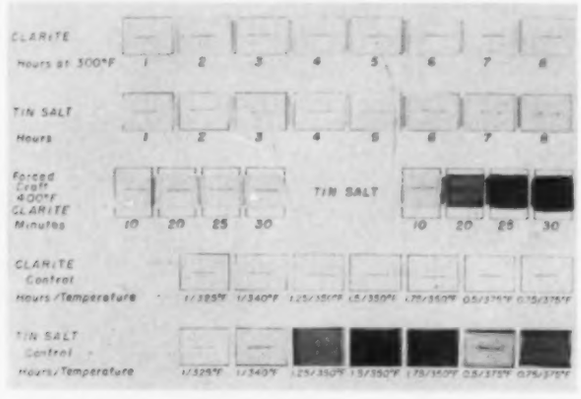

Fig. 4. Effect of stabilizers at high processing temperatures.

Table I. Effect of Vinyl Resin Type on Weathering

	Radiation, Langlies × 10^{-3}			
Stabilizer	Homopolymer (QYNA)	Copolymer (VYNW)	Paste (Geon 121)	Rigid (Geon 404)
Strontium naphthenate	25	15	10	50
Barium ricinoleate	40	35	15	50
Cadium naphthenate	45	35	15	35
Dibutyl tin dilaurate	65	40	52	40
Dibasic lead phosphite	130	130	265	110

Effect of Stabilizers

The stabilizer system is a key factor in determining heat stability, weathering resistance, and electrical properties. It may also be important in determining processing characteristics, moisture absorption, plasticizer exudation, heat sealing, printing, and other properties.

Generally, stabilizers are the metallic salts or soaps of certain metals. Some organic compounds, including epoxides and phosphites are effective when used in combination with selected metallic salt stabilizers. Figure 3 illustrates the relative general heat stability of several different types of stabilizers. In general, the tin salts, the barium-cadium-organics, and the normal and basic lead salts are the most effective stabilizers. This generalization is based on the use of dioctyl phthalate and other non-reactive plasticizers.

Basic lead stabilizers, generally the most effective heat stabilizers with non-reactive plasticizer systems, react strongly with ether ester and aliphatically unsaturated plasticizers. n-Lead stabilization, however, is highly effective and, in the case of n-lead silicates, helps minimize the spewing typical of such plasticizer system.

Aryl phosphates tend to discolor with most stabilizers, and barium-cadium-organics are usually most effective in such systems. High speed-and-temperature calendering involves a stabilization problem notably different from that normally encountered. Barium-cadium-organics are most effective for this operation as shown in Figure 4.

Adequate heat stability is required for all vinyl plastics, and weathering resistance of varying degree is an added requirement of most plastics. As shown in Figure 5, the several stabilizer types have a different pattern of relative effectiveness with non-reactive plasticizers for weathering resistance than they have for heat stability. Barium-cadium-organics, tin salts, dibasic lead phosphite and sodium salts are generally increasingly effective in the order named. It should be noted that the moisture absorption characteristics and the incompatibility with heat stabilizers of the sodium salts severely limit their practical application.

Weathering resistance is reflected not only in discoloration, tack, spotting, and stiffening, but also in other physical and electrical properties. Figure 6 compares the effect of weathering on the electrical properties of two stabilized plastics that were originally essentially equivalent in electrical resistivity.

The effect of reactive plasticizers on weathering is most pronounced. Ether ester and aliphatically unsaturated plasticizers tend to stiffen and become brittle on

short exposure. Epoxidized plasticizers also stiffen very rapidly, usually with pronounced spewing, but withstand nearly average exposure before complete embrittlement.

The aryl phosphates and, particularly, petroleum type extenders stiffen and discolor rapidly, but require greater than average exposure before becoming completely brittle. Plasticizers containing benzyl groups also stiffen and discolor on short exposure. The non-reactive plasticizers, such as dioctyl phthalate and octyl decyl adipate, generally have notably longer failure-free weathering life than the reactive esters. Figure 7 illustrates some of these general cases.

It should be noted that no satisfactory manner of preventing the rapid stiffening and embrittlement characteristic of plasticizer systems containing appreciable quantities of ether groups or aliphatic unsaturation is known as yet. Usually, the selection of the stabilizer system is relatively unimportant in the weathering of such plasticized products.

In some cases, however, plasticizer systems of generally very poor light stability can be improved greatly by careful compounding. Figure 8 illustrates such a case where the inherently poor heat and light stability properties of chlorinated paraffins are effectively overcome by highly selective stabilization, thus permitting advantage to be taken of the economy, flame resistance, and electrical properties of these plasticizers.

Effect of Plasticizers

The interdependence of plasticizers and stabilizers on weathering has been clearly indicated. Weathering considerations extend beyond light stability, however, and include properties dominated by the plasticizer system. A foremost consideration for plastics subject to weathering is the attainment and retention of suitable flexibility over a rather broad temperature range. This encompasses a combination of properties such as light stability, low temperature flexibility, and low volatile loss.

It is essential that a distinction be made between stiffening on exposure to weather owing to volatilization of plasticizer and that owing to the action of sunlight. Stiffening because of volatilization of plasticizer is a function of vapor pressure and migration rate of the plasticizer through the plastic. Dibutyl phthalate is an extreme example and dioctyl adipate a more typical example of plasticizer systems that cause stiffening due to volatile loss.

Stiffening because of sunlight is a function of the susceptibility of the plasticizer to ultra-violet radiation. The ether esters and aliphatically unsaturated plasticizers are important classes of such plasticizers. They cause much more rapid and degradative stiffening than dioctyl adipate or phthalate, for example, even when equivalent in volatility characteristics. Figure 9 compares the relative stiffening of two plasticizer systems of approximately equal volatility characteristics and illustrates the effect of ether groups on stiffening.

Low temperature flexibility is imparted by a seemingly adequate number of plasticizers. Closer inspection, however, reveals a less favorable situation. If the ether

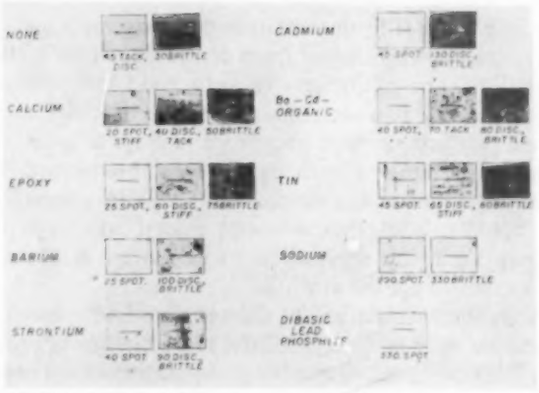

Fig. 5. Effect of stabilizer type on weathering. Figures are in thousandths of Langlies (gm.-cal./sq.cm.).

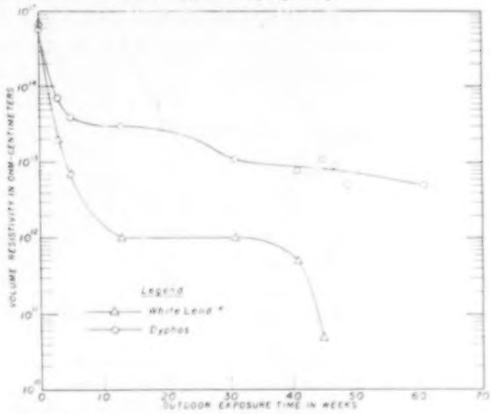

Fig. 6. Effect of weathering on volume resistivity.

Fig. 7. Effect of plasticizer type on weathering. Figures are in thousandths of Langlies (gm.-cal./sq.cm.).

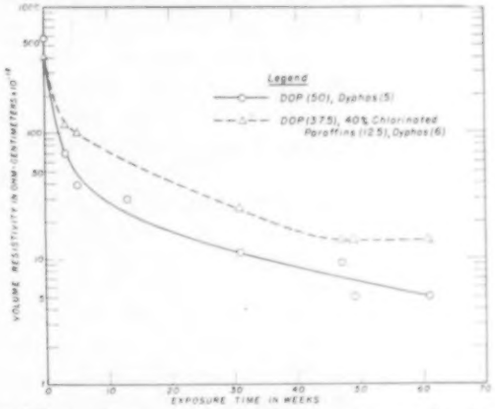
VOLUME RESISTIVITY IN OHM-CENTIMETERS
EXPOSURE TIME IN WEEKS
Legend
DOP (50), Dyphos (5)
DOP (37.5), 40% Chlorinated Paraffins (12.5), Dyphos (6)

Fig. 8. Effect of proper stabilization on compounds plasticized with chlorinated paraffins.

esters, eliphatically unsaturated, and extremely volatile plasticizers are eliminated from consideration for quality defections, few plasticizers of very good low temperature flexibility remain. Among the commercially established products, trioctyl phosphate, dioctyl adipate, and dioctyl sebacate are perhaps the most prominent. Yet trioctyl phosphate has severe limitations in compatibility, stability, and other respects; dioctyl adipate is too volatile for many applications; and dioctyl sebacate is too expensive for general use.

A common "solution" to the problem is the use of a plasticizer such as dioctyl adipate to obtain low temperature flexibility, and the subsequent addition of a polyester to offset the volatility of the dioctyl adipate. Table 2 indicates that the usual result of such a procedure is an overall loss of quality and increased cost, even before considering somewhat more subtle losses in processing, heat stability, and weathering.

Table 2. Properties of Mixed Plasticizer Types

Plasticizer	Low Temp. Flex. (T_f), °C.	Volatile Loss, %	Increased Cost, ¢/lb.*
DOP	—20	14	——
DOA	—40	40	$0.12
DOP/DOA/G-50	—21	19	$0.07

*Approximate increase in cost per pound of plasticizers used, compared to DOP.

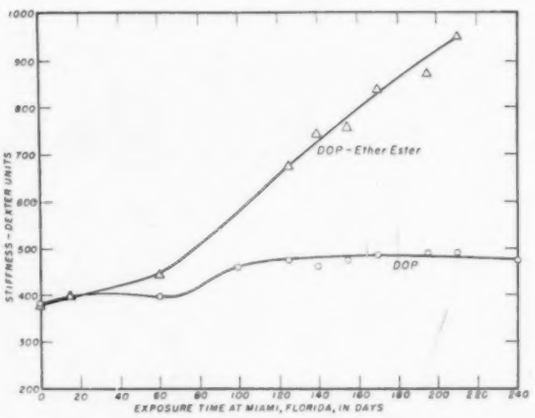

Fig. 9. Effect of ether-ester plasticizers on stiffening.

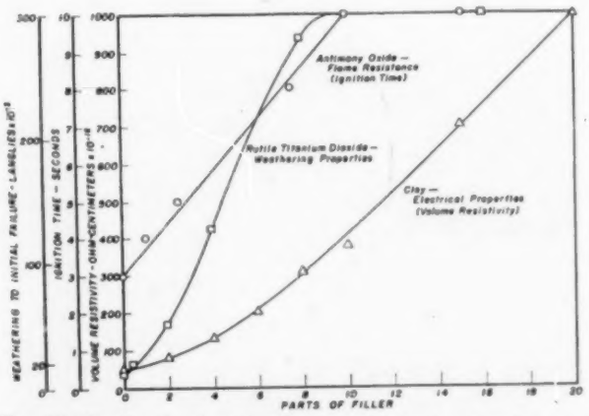
WEATHERING TO INITIAL FAILURE - LANGLEIES x 10⁻³
IGNITION TIME - SECONDS
VOLUME RESISTIVITY - OHM-CENTIMETERS x 10⁻¹⁴
Antimony Oxide — Flame Resistance (Ignition Time)
Rutile Titanium Dioxide — Weathering Properties
Clay — Electrical Properties (Volume Resistivity)
PARTS OF FILLER

Fig. 10 Effects of selected fillers on weathering, ignition time, and volume resistivity.

Quality-cost considerations lead to the conclusion that a mixed plasticizer system is indicated for most outdoor applications. Thus reconsideration of "low temperature" plasticizers as 25% of the plasticizer system in combination with DOP reduces the magnitude of any defects in compatibility, stability, etc., and provides a more practical basis of comparison.

Such an approach also draws attention to the fact that the several plasticizers do not retain the same order of merit in regard to low temperature flexibility upon dilution, as they do when used alone. Table 3 compares the relative effectiveness of several selected plasticizers in attaining the combination of properties that serve as a basis for permanent flexibility.

Effect of Fillers and Pigments

Fillers are not, and should not be, employed indiscriminantly in vinyl plastics. Judicious selection of materials and concentrations, however, can improve some properties substantially. Figure 10 illustrates the benefits in electrical properties, weathering resistance, and flame resistance derived through the use of clay, rutile titanium dioxide, and antimony oxide, respectively.

Dimensional stability, required in floor tile, is greatly improved by the use of selected asbestos fibers. Provisions must be made for contamination of the asbestos, however, by addition of n-lead salicylate to prevent discoloration. The economic advantages of fillers can be realized in some applications by careful selection of specific materials and quantities such that critical properties are not impaired.

The effect of typical fillers on weathering resistance is illustrated in Figure 11. Silicic fillers, which constitute an important proportion of the fillers available, generally have a pronounced deleterious effect on weathering. A few special clays and whitings are relatively innocuous. Coated whitings offer improved weathering resistance, but reactive coatings should be avoided.

Antimony oxide, rutile titanium dioxide and carbon black, are increasingly beneficial to weathering properties. Rutile titanium dioxide absorbs essentially all the ultra-violet radiation. Studies of the effect of rutile and anatase titanium dioxides on the weathering of vinyl plastics clearly show that the better results obtained with the rutile type is not due to tinting strength.

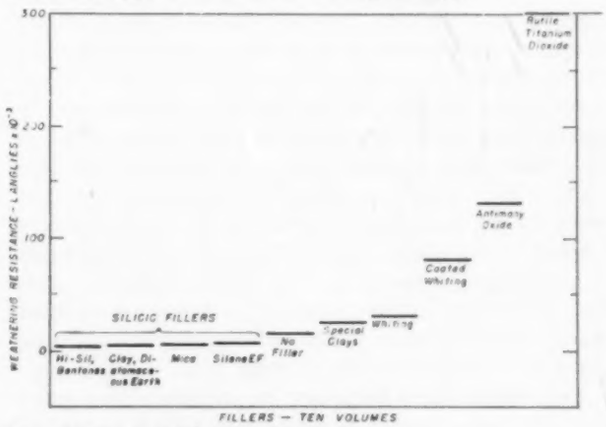

Fig. 11. Effect of filler type on weathering.

Table 3. Comparison of Plasticizers Mixed 25/75 with DOP

Plasticizer	Low Temp. Flex. (T_f), ° C.	Increased Cost, ¢/lb./° C.*	Volatile Loss, %	Heat Stability	Weather Resistance
DOS (—45° C)**	—25	1.54	12	Good +	V. Good
TOP (—46° C)	—23	1.1	16	Poor —	Poor
DOA (—40° C)	—24	1.0	24	V. Good	V. Good
DOZ (—42° C)	—26	0.73	13	Good	Good +
F-31 (—43° C)	—26	0.55	13	V. Good	Excellent —
F-41 (—42° C)	—28	0.44	13	Excellent	Excellent
DOP (—20° C)	—20	——	14	Excellent	Excellent

* Approximate increase in cost per pound of plasticizers per C° improvement in low temperature flexibility as compared to DOP.
**Figures in parentheses indicate the low temperature flexibility when the material is used as the sole plasticizer.

Table. 4. Comparison of Natural and Artificial Weathering Tests.

Condition	Average Deviation in Order of Merit	Type and Number of Failures in 19 Specimens			
		Spotted	Stiff	Discoloration	Tacky
Outdoors (average)	——	14	4	4	6
S1, S4, RS ultra-violet lamps	3.6-4.7	0-3	10-17	13-17	5-11
Fade-O-Meter, at 125° F.	2.3	12	4	7	6
At 200° F.	3.4	9	3	10	4
Weather-O-Meter,					
Twin Arc, dry	1.6-1.8	14-16	3	3-2	9-11
XW, dry	2.8	9	11	14	7
XW, continuous water spray	5.1	2	17	3	0
XIA, 18 minutes water spray/102 minutes dry	2.6	10	14	10	1
BWM-C, dry	1.8	13	3	6	5

General Weathering Considerations

Effects of Seasons

The season of the year during which the films are exposed is important and has a pronounced effect on both the order of failure and the type of failure. More is involved than simply extending the time required for failure. It is evident that different degradation mechanisms having different energy requirements are involved. Spotting and tack formation are less common types of failure in winter exposures than in summer, and the relative number of failures from stiffening and discoloration are increased.

Exposure Under Glass

Exposure under glass rather than directly to sunlight has an effect that is similar in some ways to initial exposure in the winter; i.e., failures from spotting and tack formation are reduced relative to those from stiffening and discoloration. The effect of glass is related, also, probably in a similar way, to that obtained by use of rutile titanium dioxide, in that window glass absorbs much of the ultra-violet radiation of sunlight and results in increased exposure time-to-failure of the plastic.

Measuring Exposure Radiation

The time to failure varies greatly with the season and, to a less but important extent, with the location. Exposure time is obviously a poor measure of exposure since no consideration is given to the amount of sunlight. Measurement of total radiation as an index of exposure is a much better approximation of the true exposure. This method still leaves much to be desired, and several groups interested in the weathering of plastics expect to start evaluation of practical means of measuring ultra-violet radiation in the coming year.

Need for Periodic Checks

Periodic inspection and testing of plastics exposed to either natural or artificial weathering is essential in order to obtain reliable information. Once degradation of the plastic has started, it continues after removal from exposure. This emphasizes the necessity for testing samples immediately after removal from exposure.

Natural vs. Artificial Weathering

Recognition has been given the lack of correlation between natural and artificial weathering tests. Table 4 summarizes, in as concise a manner as possible, the results of extensive tests conducted on 17 selected films at 6 outdoor locations and under 25 different artificial weathering test conditions by the SPI.

The nature of the radiation at the sample, temperature conditions, and use of water sprays proved critical. Sunlamps caused failure predominantly by discoloration and stiffening rather than by spotting, and the order of failure so obtained differed greatly from actual outdoor exposure. Water sprays appear helpful under certain conditions, but if the spray is operated continuously it prevents tack and spot formation which are essential weathering characteristics of many films.

The Fade-O-Meter and BWM-C Weather-O-Meter operated at a black panel temperature of 125° F. gave

Cont'd. on page 90

Guest Editorial

Merrill David Color Studios, Inc.

The Injection Machine Picture

A. R. MORSE, *President*
Injection Molders Supply Co., Cleveland, Ohio

Recently, the three leading injection machine manufacturing firms were sold outright to other companies within a remarkably short period of time. (One transaction is not final at the time of this writing.) This was newsworthy, but no one has speculated on the implications of these transactions to the injection molder. This, then, is one man's viewpoint; a kind of informed thinking-out-loud about problems that eventually could affect all of us in the injection field.

I believe that these three major sales, coming as they did, could betoken vital changes in equipment and policies that might well have far-reaching effects on the entire injection molding industry. All of the three press makers could undoubtedly be considered as being stabilized by affiliation with a parent company. Contrariwise, I feel that some of these concerns were really attractive buys, and were actually better balanced in ratios and values than the purchasing companies themselves. Thus, liquid assets that possibly might have gone into the press field, could conceivably be funnelled off for use elsewhere. So while the press makers can be considered as strengthened from one viewpoint, they can also be considered as weakened from another. Such a consideration is obviously vital to the long-range policies of the other five major injection machine builders, as well as to the molders.

In the overall picture, the three largest injection machine makers all have had a high percentage of their total sales originating from other lines of machinery. All were successful, and had impressive records of accomplishment. But what has always intrigued me most about them was that all three owed their basic success to certain outstanding personalities. To each of these men, the injection press business owes an undying debt of gratitude.

These positive individuals were absolutely indispensable to their respective companies in their major growth years, but each displayed a human failing. Each of these dynamic and indispensable men went on the theory that all subordinate personnel was a mere commodity that could be replaced easily. Here, I think they all missed the chance to build up teams that today could be standing the successor companies in good stead. In fact, each of the major press companies could well have been regarded until now as essentially a one-man business. Now they are all suddenly in a stage of transition, growth, and integration on the way towards becoming big business. This could be painful all around for a while.

A new management may not take the same attitude as the predecessor on the ticklish matter of guarantees, for example. They have only figures and facts to go on, not the broad understanding of the trade that often tempered their predecessors. Thus, molders who buy presses and chance to wreck them may find that they can no longer wring the concessions they once could from the machine manufacturer.

Another implication involves machine repair parts. In one year, one of the selling companies apparently did more business in parts than in new equipment. There is not too much profit in repairs, taken by themselves, as they amount to job shop work, and costs are high without parallel production to spread set-up charges. What will a management unversed in the extremely cyclical nature of the injection press business say to this?

Injection molders are all familiar with the comparative shortage of presses that existed up to 1954 when, for the first time in our trade's short history, competition became really keen between press makers for any length of time. At this time, wholly redesigned and new lines of presses appeared almost overnight, incorporating changes that formerly took years to produce, such as larger platens, quieter pumps, and better plasticizing. How will new managements view the competitive cyclical situations which, together, involve millions of dollars often committed a year or more in advance, especially when this risk is predicated on

Cont'd. on page 94

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F. J. BOCKHOFF, *Associate Director of Research*
American Agile Corporation, Bedford, Ohio

X-Ray Inspection Methods in Plastics Fabrication

X-ray and fluoroscopic methods provide for rapid, non-destructive inspection of fabricated parts to maintain quality standards.

The use of plastics fabrications in the chemical process and allied industries is expanding at an ever increasing rate. The particular factors responsible are increased corrosion resistance in the presence of many environments to which most metals are not suited, light weight, ease of fabrication, and highly variable mechanical and electrical properties. It, therefore, becomes increasingly important to maintain strict quality control over these fabricated installations. Owing to the highly corrosive nature of many of the materials handled in plastic equipment, the complete absence of structural defects must be insured and guaranteed by the manufacturer.

X-ray testing provides a vital method for rapid and thorough examination of plastic materials in a completely non-destructive manner.

In operations such as the extrusion molding of large opaque structures, thermal shrinkages during cooling may cause cavities or voids hidden within the material where this type of defect usually passes entirely unnoticed. Even with translucent white polyethylene, the brightest inspection lights are of negligible help.

On occasion these cavities have been observed to be as large in volume as several cubic inches, but are generally much smaller. If not detected initially, the flaws may appear after lengthy machining operations, thereby involving unnecessary labor expenditures. On the other hand, if the cavity or other defect remains undetected, a serious material weakening may result which may cause eventual failure under field conditions.

In addition, x-ray inspection methods are highly adaptable to compression molded sheets, centrifugal castings, and welded constructions of all types. The actual methods to be used, however, vary with the type of material or specimen to be examined, and the relative magnitude of the defect.

Nature of X-ray Testing

The wave length of x-radiation is the region of 10^{-8} centimeters. Owing to this extremely short wave length, x-rays can pass readily through most materials. For the same reason, x-rays can be refracted to only a very slight degree by even the most dense metals and, therefore, are extremely difficult to focus. Radiographs, or x-ray photographs can however be produced by placing film behind the specimen to obtain a shadow picture or outline, with film density variations dependent upon the material thicknesses. Any defect resulting in a dimensional change of greater than one percent can be detected readily and recorded permanently on film (1).*

X-rays are produced when high velocity electrons strike a solid. In the conventional x-ray tube, electrons are thermionically supplied by heating a filament to incandescence. The filament is made the negative electrode or cathode, and a metal such as tungsten is made the target anode. A high voltage applied across the anode and cathode causes these emitted electrons to bombard the anode, which results in the generation of x-rays.

The nature of the x-ray output of conventional equipment is governed by tube voltage and filament current

* Numbers in parentheses refer to bibliography at end of article.

control. Higher voltages produce "harder" x-rays of shorter wavelength and correspondingly higher penetrating power. Voltages in the range of 20-80 Kilovolt Peak are very satisfactory for the radiographic inspection of plastic materials, whereas much higher voltages are required for the inspection of comparable fabrications in metals.

The filament current, the second controlling factor, determines the rate of emission of electrons, or tube current, from the cathode and, therefore, controls the intensity of the x-ray beam but does not affect the wavelength. Current control is extremely important in exposure conditions for radiographs. The radiographic energy in any exposure may be given (2) as:

$$R = V^y (It/d^2)$$

where: R = radiographic energy
V = tube voltage, usually in kilovolts
I = tube current, usually in milliamperes
t = time, in seconds or minutes
d = distance from target to film, in inches or centimeters

The exponent y of the voltage in this formula may vary considerably with the conditions under which the exposure is made. The term, It/d^2, is known as the exposure factor and, if maintained constant for a given application, will produce comparable film exposures even though the current, time, and distance vary within the group.

Since rated values on different generators vary considerably, it is wise to determine the specific optimum exposure factors for the various applications desired and record them for routine work.

Application of X-ray Testing

Figure 1 illustrates a typical radiograph, showing a soundly welded valve construction in rigid polyvinyl chloride. The three outer weld beads at each corner are clearly outlined, and there is no evidence of incomplete weld penetration. In addition, the alignment of the valve stem is observed to be quite satisfactory.

Figure 2, however, illustrates a defective weld in a polyethylene Y-valve. The failure to obtain complete penetration at the inside diameter of the weld can be clearly observed. A weld of this type might give satisfactory field service for a considerable time. Owing to the decreased strength of the faulty weld, however, no assurance of satisfactory service can be guaranteed and the valve should be rejected. It might be noted that the dark valve stem assembly is polyvinyl chloride, which has a lower x-ray transmittancy than polyethylene.

In making good radiographs, several points should be kept in mind. The x-ray target-to-film distance should be as large as possible to minimize distortion. In addition, the plane of interest should be parallel to the film and perpendicular to the x-ray beam. It is evident that distortion cannot be eliminated completely in any type of shadow photography of non-planer objects, but it can be minimized considerably by following the previous rules.

The degree of contrast in the print is a function of the thickness ratios in the specimen and the type of film. Films having varying degrees of contrast are readily available for x-ray exposure, and can be selected to fit the desired need.

Fluoroscopic Testing

X-ray inspection, however, need not involve the use

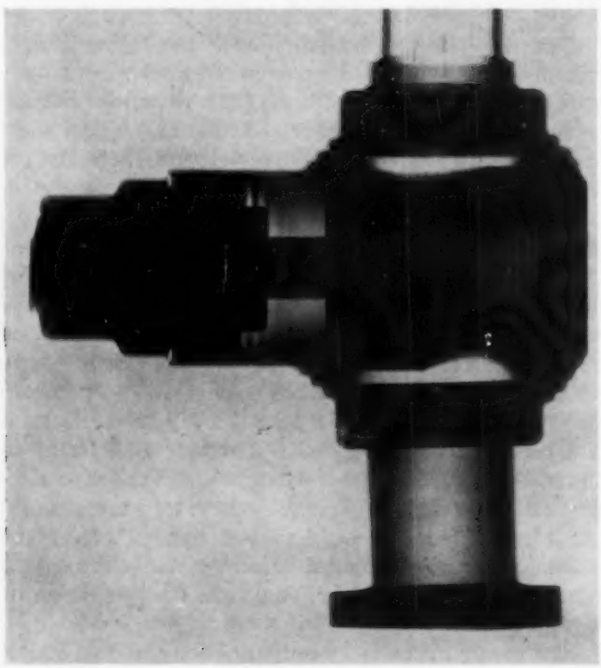


Fig. 1. Radiograph of Soundly Welded T-Valve Made of Rigid Vinyl. (Exposure Conditions: 50 Milliamp-Seconds and 40 Kilovolt Peak at 40 Inches).

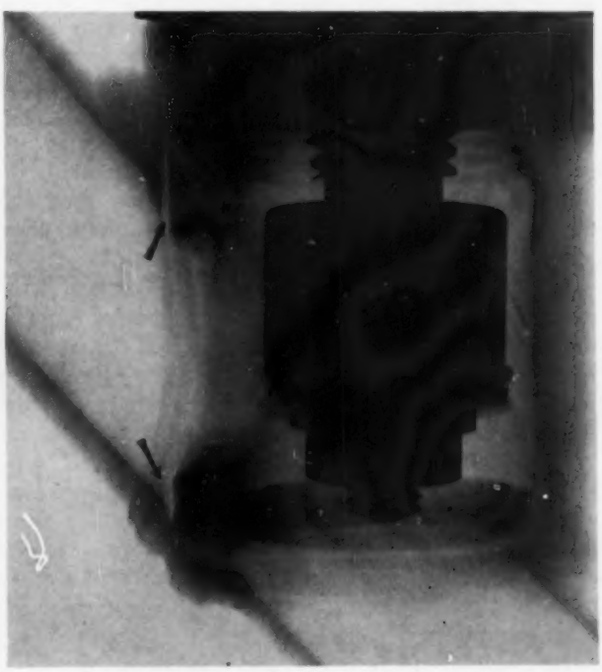


Fig. 2. Radiograph of Defective Weld on Polyethylene Y-Valve. Arrows indicate Failure to Fill the Undercut. (Exposure Conditions: 50 Milliamp-Seconds and 30 Kilovolt Peak at 40 Inches).

of film and time consuming processing. In fluoroscopic examination, a fluorescent screen is substituted for the film plate. The incidence of x-rays upon the screen causes the fluorescent material to emit visible light, so that the specimen can be examined immediately. A satisfactory arrangement for fluoroscopic inspection is shown in Figure 3. The x-ray source is below the table and the fluorescent screen is mounted above the piece to be inspected in such a manner that its motion is synchronized with that of the source. This arrangement allows simple movement of the unit across the entire table. Fluoroscopic ratings on generators are generally in the range of 2-7 milliamps at 85 Kilovolt Peak. Fluoroscopy has certain advantages over radiography with respect to speed, low cost, and ability to examine moving parts or to inspect large objects. Large plastic sheets can be rapidly scanned with a fluoroscopic screen, whereas complete radiographic inspection would entail much more time and cost. All rod, tube, bar, and similar stock can be economically checked for defects in a surprisingly short time.

Compared to radiography, however, fluoroscopy also has its limitations. The grain size of the screen prohibits the fine resolving power possible on film, and contrast cannot be made as marked. The energy requirements for a screen are higher because of the instantaneous nature of the excitation, whereas the radiographic energy requirements for film exposures are cumulative with respect to time. It is this high energy faction which prohibits the use of fluoroscopy in routine inspection of metal parts which are much more dense than plastics.

Most quality control work in plastics fabrication, however, can be done more easily and more economically by fluoroscopy than by radiography. Extruded pipe and rod can be continuously examined on the line by fluoroscopy and marked for removal. Hidden assemblies can be readily checked for alignment without dismantling.

In those particular cases where the demand for detail is high, such as weld examination, radiographic exposures can be made.

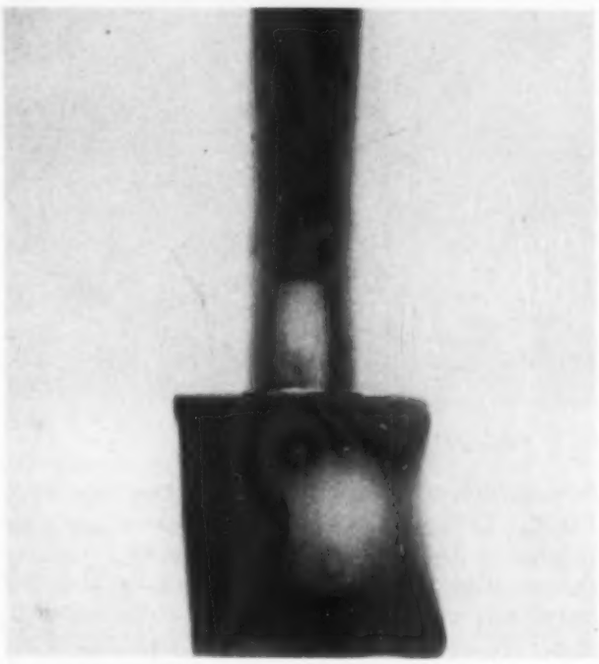


Fig. 5. Fluoroscopic View of Defective Molded Polyethylene Plastic Rod Stocks (Two- and Five-Inch Diameters). Shrinkage Cavities are Quite Evident.

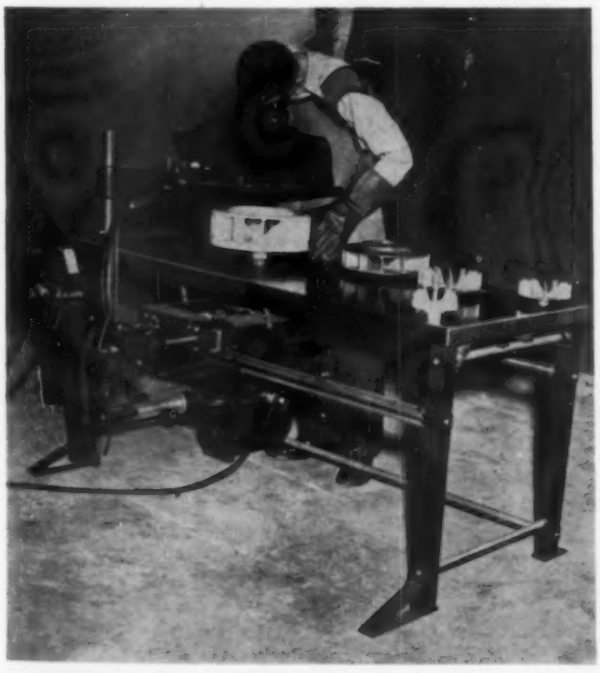


Fig. 3. Fluoroscopic Examination of Polyethylene Rotors for Exhaust Blowers. (See Figure 4).

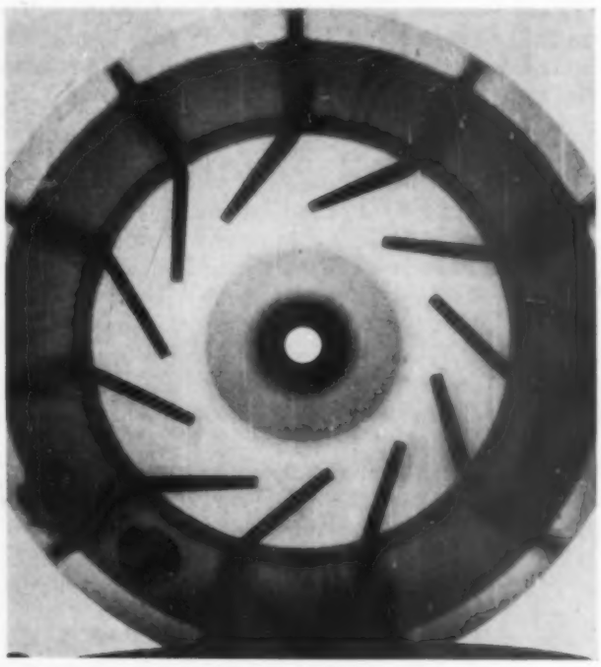
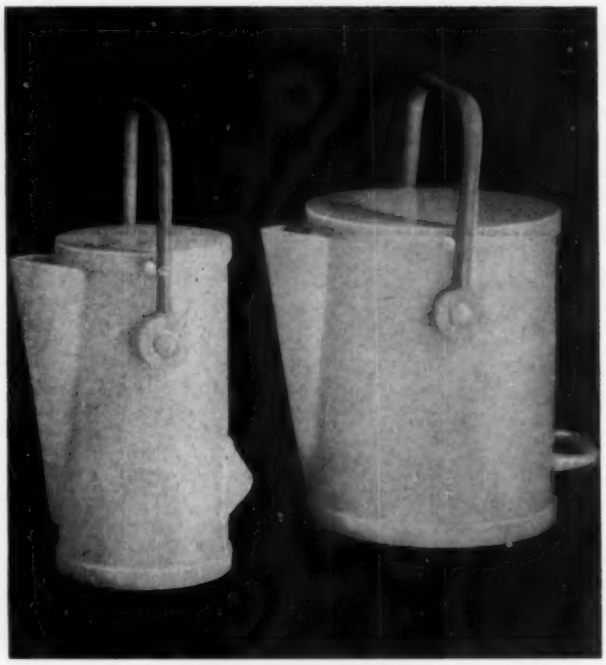


Fig. 4. Fluoroscopic View of 16-Inch Diameter Polyethylene Rotor for Exhaust Blower. (See Figure 3).



Symes & Olds Co.

Fig. 6. Fabricated Polyethylene Safety Jugs.

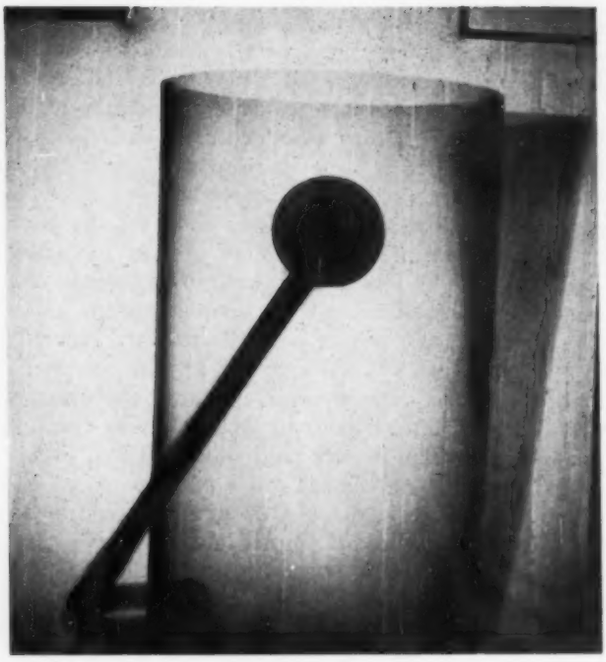


Fig. 7. Fluoroscopic View of Polyethylene Safety Jug.

Application of Fluoroscopy

A fluoroscopic view of the welded rotor shown being examined in Figure 3 is given in Figure 4. This is merely a standard photograph of the fluorescent screen. The general lack of detail as compared to radiographs can be readily observed. Vertical background streaks are caused by the plywood table top, and will be noticed in all of the fluoroscopic photographs to be presented.

The difference in x-ray penetration is clearly illustrated in this figure when one compares the densities of the aluminum core, the steel set-screws, and the polyethylene structure. The two dark spots at the lower left are thin layers of lead putty which were applied on either side in a previous dynamic balancing of the rotor. The rotor will be corrected in weight by these amounts and the lead putty will be removed.

Shrinkage cavities in extrusion molded black polyethylene rod stock are shown in Figure 5. These cavities are not always located at rod extremities, as illustrated, but are quite often located in central regions.

Figure 6 illustrates various welded bottles and safety jugs fabricated in polyethylene. A fluoroscopic view of a jug is presented in Figure 7. The steel reinforcement in the polyethylene handle is quite evident because of the high film density. The three holes leading from the cylinder to the spout can also be noticed along the right edge of the cylinder.

Inspection of the fluoroscopic photographs presented reveals that weld detail is quite poor, emphasizing again the necessity for radiography when high detail is required. Defects much smaller than ⅛-inch in diameter may completely escape notice in many fluoroscopic inspections, especially in thick structures.

Regardless of the type of inspection method employed, safety considerations should be foremost in the minds of x-ray operators. Safety requirements are standardized (3) and should be consulted and maintained.

Summary and Conclusions

The use of x-ray testing for quality control of commercial plastic materials and fabrications enables the manufacturer to maintain higher product standards at lower cost. Unnecessary machining is eliminated. The shipping of faulty stock or defective construction is avoided, and customers are given a sense of confidence in their guarantees of materials and workmanship.

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"Weathering Properties of Vinyl Plastics," cont'd. from page 17.

reasonable correlation with outdoor exposures. This operating temperature is lower than those ordinarily used or obtained, but can be obtained by simple adjustment of the machine.

Summary and Conclusions

It is suggested that a realistic approach to weathering requires a philosophy of quality. The development of vinyl plastics capable of withstanding ultra-violet radiation, in addition to extremes in temperature and atmospheric conditions, without undue change in properties requires a careful balancing of a series of properties. A number of the basic principles relevant to this problem have been established. Rapid progress is being made in establishing the remaining factors governing permanent flexibility. Their resolution will lead inevitably to new and extended applications of vinyl plastics.

Pincombe Studio

Precision Control of Injection Molding Pressure[1]

Two major problems in achieving precision control of injection molding pressure are discussed and solutions suggested.

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Precision control of plastic pressure during injection molding has been the subject of much detailed study during the past several years. Some of the information which has been obtained has pointed the way to several improvements in control of the plastic pressure.

The significance and the numerical values of pressures inside an injection mold have been pointed out (1)[2]. Pressure control has been shown to be the key factor in controlling mold release forces and inherent molding stresses in the finished part (2). Dimensional accuracy of the finished part has been shown to be a function of pressure control in the mold (1) (3). Resistance to distortion at elevated temperatures has been accepted as a function of pressure control inside the mold.

Several means of pressure control have been employed by injection molders. The temperature, pressure and time controls of molding machines provide relatively wide latitude for this purpose. Balanced gate resistance, flow control within the cavities, mold temperature controllers, restricted gates, ball check nozzles, and weighed-starved feeding of the molding granules have been employed individually and in systematic combinations to control the plastic pressure. These principles and mechanical devices have been highly successful in improving the quality of injection molded articles and in decreasing the cost of the molding operations.

It has become well established that the most effective and precise means of controlling pressure in the mold is to place the exact, correct weight of plastic in the mold as quickly as possible (4). Weighed-starved feeding of conventional injection molding machines has been effective in placing the correct weight of granules in the mold, and preplasticizing molding machines have been highly effective in filling the mold quickly.

These two technical developments have accomplished much in broadening the range of safe and economical application of thermoplastics as engineering materials. The success of some applications formerly not considered feasible has aroused the interest of design engineers in expanding the use of thermoplastics to new fields. Some precision considerations in weigh feeding and preplasticizing techniques must now be added to the early, rather crude technology in order to provide better dependability and uniformity. These newly considered precision factors may be expected to be called "crude" in turn as their practice uncovers further and heretofore hidden factors of precision.

Weighed-Starved Feeding

Weighed-starved feeding has been found to have some inherent problems which interfere with attaining sufficient precision of pressure control in the mold to make this technique universally applicable for the most exacting molding requirements. Two problems are critical: (1) accuracy of the feeding device; and (2) precision pressure control through a standard injection machine heating cylinder.

Accuracy of the Weighing Device

The principle of weighed-starved feeding is to place the correct amount of plastic granules in front of the injection plunger and push them forward into the heating cylinder until the injection piston can move forward no farther because it is in contact with the front hydraulic cylinder head. With this means of operation, it is possible to hold the plastic in the mold until the gate has solidified sufficiently to prevent discharge of plastic from the mold. If a cushion of plastic granules remains ahead of the injection plunger after the mold is full, the hydraulic pressure in the oil cylinder is capable of forcing more plastic to creep into the mold during the next few seconds, and this causes packing which results in high residual stress in the molded piece.

The operation of weighing the charge of molding granules is subject to some lack of precision. No weighing device can measure the exact weight at each cycle of weighing, and the weight may be expected to be heavier or lighter than the correct amount. This inac-

[1] Presented before the Rubber and Plastics Division, American Society of Mechanical Engineers, New York, N. Y., Dec. 3, 1954.

[2] Numbers in parentheses refer to bibliography at end of article.

curacy is usually cumulative, and sooner or later the molding operation departs too far from equilibrium. The heating cylinder will gradually build up a cushion of granules which stops the plunger before it completes its full stroke if the weight of the charge is slightly on the heavy side. Conversely, if the weight is slightly too light, the heating cylinder will be gradually starved until short unfilled parts result.

This inaccuracy is in the range of $\pm 0.5\%$ and is not excessive in itself for many molding applications. Press operators can make periodic compensating adjustments to hold the finished parts within good limits as far as dimensional accuracy, residual stress and heat resistance are concerned. Some applications of molded parts require closer control, however, and automatic molding machines surely need better control.

It has been difficult for press operators to learn to compensate for the inherent and usually small inaccuracy of the weighers because of some shortcomings in mechanical dependability of the weighing machines. Some expected improvements will separate inaccuracy from plain lack of dependability which, at present, is often a greater factor in making frequent adjustments necessary. Improved dependability is the aim of the manufacturers of weighing machines for injection molding applications, and considerable progress has been made.

Self-compensating weighers have been proposed, and they can be effective in overcoming the inherent inaccuracies. If compensation is controlled by the position of the injection plunger at the end of the injection stroke, the compensation for inaccurate weighing will be so coarse that it will not add to the precision which is already available. The only way in which a compensating weigh feeder can be controlled by plunger position is to operate with a cushion of granules in front of the plunger which is maintained at a constant height by the compensating feature of the weigher. This is reasonably satisfactory for some applications, but is not very precise.

Compensation of the charge weight should be based on the pressure which exists in the fluid plastic at the instant the hydraulic piston reaches the front cylinder head. This places control of the molding system upon the plastic pressure which is the factor to be controlled. Furthermore, it can provide compensation for the second inherent problem; precision control of pressure through a conventional injection molding heating cylinder.

Conventional Heating Cylinder System

Figure 1 is a schematic diagram of a conventional injection molding heating cylinder, which may be defined as receiving a charge of cold granules at one end and delivering a charge of melted plastic from the other end into the runner system of the mold. Immediately in front of the injection plunger upon completing its forward stroke, there is a region of packed granules which extends some indefinite distance forward into the heating cylinder. These granules become increasingly softer and more nearly melted toward the nozzle end of the heating cylinder, as indicated by the diagram.

When weighed-starved feeding is employed, the injection plunger must stop its forward motion at a fixed position upon completion of each stroke, and is restrained by the front hydraulic cylinder head. The plunger is relatively rigid, but the plastic between the end of the plunger and the gate of the mold is rather highly compressible. Figure 1 shows this compressible portion of the plunger system which exists inside the heating cylinder. Figure 2 shows the complete plunger system and divides it into rigid and compressible portions. The compressibility of the plastic portion of the plunger system can introduce much more inaccuracy in a weighed-starved feeding system than does the actual weigh feeding machine.

The front end of the plunger transmits pressure through the packed granules and through the fluid plastic into the heating cylinder and runner system and thereby into the mold. The fluid plastic is compressed to some extent, perhaps, 4-7%, after the plunger reaches its forward position with the mold closed. The packed granules also are compressed. Thus, a considerable pressure exists on the plastic material which is trapped between the closed mold and the forward end of the plunger during the time the plunger is held forward, even though the plunger cannot move any farther forward at this time.

A plug of packed granules acts as an extension of the plunger and transmits pressure to the fluid plastic. The rigidity of this plug of granules can vary because of several factors; temperature, external lubrication, size and shape of the granules. If the granules are hot they crush together readily and shorten the effective length of the plunger. If the granules are well lubricated externally they slip past each other more easily than do dry granules, and so occupy less volume. The size and shape of the granules have similar effects on packing.

The resistance to flow through a heating cylinder depends principally on the mass-average temperature of the fluid plastic, and the sliding friction of the cold plug of granules against the heater wall. Slight variations in the time cycle of the molding machine can cause considerable variation in the average temperature of the fluid plastic and, in turn, the fluidity or ease of pushing the plastic through the heating cylinder. This variation in resistance to flow of the fluid plastic causes a change in the compressive load on the packed granules. This changes the height of the column of granules and, in effect, changes the position of the end of the injection plunger and its effective length. The friction of the plug of granules against the heater wall has a similar effect.

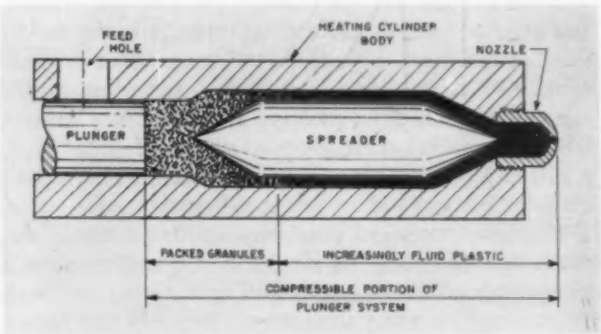

Fig. 1. Schematic diagram of conventional injection molding heating cylinder showing compressible portion of plunger system.

Thus, a change in the average temperature of the fluid plastic causes a variation in the amount of plastic which is introduced into the mold. A variation in the temperature or lubrication condition of the granules causes a difference in the compressibility of the column of granules and changes the effective length of the plunger. Both factors may be operating simultaneously or separately, and their effects may or may not be cumulative. Hence, these conditions of compressibility in the plunger system can amount to much greater variations in the amount of plastic introduced into the mold than the relatively small inaccuracies of an uncompensated weigh feeding device.

Difference in the effective length of the plunger due to variation in compression of the fluid plastic is probably a considerably lesser factor than the variation of the plug of cold granules. The compression of the fluid plastic, however, is not negligible. These variations in compressibility of the plunger system can be compensated for if the control is based on the pressure of the fluid plastic in the nozzle of the molding machine. Installing a pressure control device at this point is not a simple matter because of space limitations. A simple pressure limit switch is needed to perform the control signaling at this point.

It is possible for the molding machine operator to compensate to some extent for the compressibility of the plunger system by means of plastic temperature and time cycle adjusments. If the weight of the charge is correct, changes should not be made in the weighing device but should be accomplished by means of temperature and time adjustments. This type of compensation may be required during relief periods when a different operator is at the machine. No two operators work exactly alike with regard to time cycles. Relief operators may find the machines go out of equilibrium, and may make adjustments to the weighing device. When the regular operator returns, he finds the machine is out of equilibrium for him. This condition is also likely to occur at the time of shift changing.

The weighed-starved feeding system is so sensitive that a few seconds time delay in a cycle can cause a change of equilibrium conditions. Ten seconds is more than enough to throw the weigh feeding system out of balance. If the operator does not realize this, he finds himself adjusting the weighing machine in a futile attempt to obt in equilibrium again. This excessive adjusting has brought about considerable unwarranted criticism of the mechanical dependability of the weighing units.

Preplasticizing Machines

Recent experience with preplasticizing machines which employ a heating chamber of some kind to introduce fluid plastic into a transfer or injection chamber have indicated there is considerable advantage in this technique. High injection speeds can be obtained, and molds can be filled in one second or less. The higher injection speeds result in much better pressure distribution inside the mold, and much less difference in pressure between the region at the gate and the remotest extremity of the mold. The conventional heating cylinder

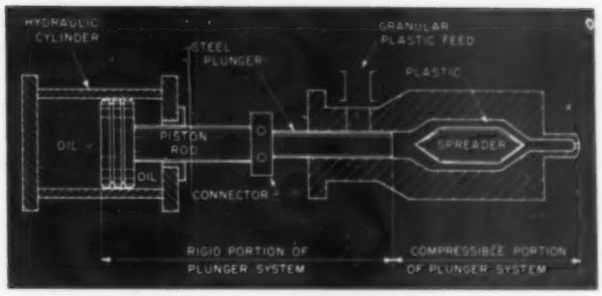

Fig. 2. Schematic diagram of complete plunger system for injection molding.

cannot fill the mold as rapidly as preplasticizing machines without having an excessively large hydraulic power plant. Furthermore, preplasticizing makes it possible to overcome the disadvantage of compressibility of the plunger system which is brought about by packed granules.

Figure 3 is a schematic diagram of a preplasticizing system which is a composite of several systems now in use. There is no preplasticizing system exactly like the one illustrated which has embodied advantages from several devices and has avoided the disadvantages of others.

In this machine the fluid plastic is introduced in front of the injection plunger which is pushed back as the plastic enters. This minimizes the introduction of air into the molten plastic. Some systems employ a heating cylinder which introduces the fluid plastic into an open injection chamber at a time when the injection plunger is withdrawn. There is considerable danger of introducing air into the plastic in such systems, although it is possible to operate them with reasonable satisfaction. Air introduced into the fluid plastic is likely to cause detonation inside the injection cylinder. The air is compressed rapidly and becomes hot enough to burn the plastic until the oxygen present is consumed. This burning usually occurs so rapidly that there is a sharp detonation and the plastic then comes into the mold with black streaks.

While plastic is being introduced into the injection cylinder the nozzle valve is closed so no leakage can take place out of the nozzle tip. The fluid plastic forces the hydraulic piston back until the extension rod hits the preadjusted stop shown in Figure 3. If a constant pressure condition is employed on the plunger of the heating cylinder and it, in turn, is able to transmit a

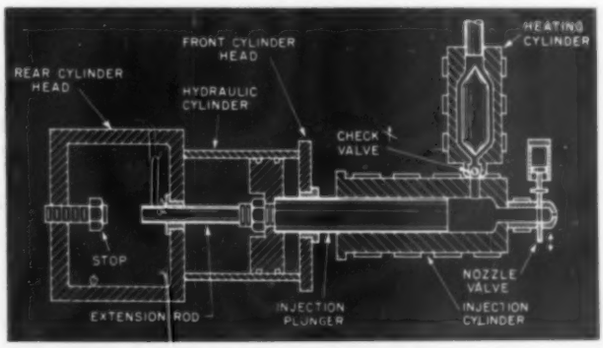

Fig. 3. Schematic diagram of a preplasticizing system for injection molding.

constant pressure on the fluid plastic, it is possible to measure the weight of the charge rather accurately even though this measurement is actually by volume of fluid plastic under constant pressure and temperature conditions. Experience to date indicates that this is a feasible and simple method of introducing greater precision into the injection molding process.

When the injection plunger moves forward, it must move until the hydraulic piston comes into contact with the front cylinder head. During this time the nozzle valve must be open and the check valve on the heating cylinder forced into a closed position to prevent backflow of the fluid plastic into the heating cylinder. The plunger may be either held in the forward position until the gate has solidified sufficiently to prevent plastic discharge from the mold or withdrawn immediately while the nozzle valve is closed simultaneously.

Some molding systems employ a receiving chamber which takes melted plastic from the heating cylinder and then dumps the charge into the injection cylinder. This allows the receiving chamber to hold fluid plastic under more nearly constant pressure conditions, and to deliver it to the injection chamber under better pressure control conditions.

Summary and Conclusions

Greater precision in the control of injection molding pressure can be obtained most readily by recognizing the major problems and dealing with them first. Improved dependability of weigh feeders will provide a considerable improvement before it is necessary to compensate for the inherent weighing inaccuracy. Careful attention to uniform molding cycles can provide better precision without automatic compensation. Automatic compensation needs dependable equipment and uniform molding cycles before it can be effective.

The systems which are discussed in this paper are suggested as a means of increasing precision in the injection molding process. Some of the features which are shown are subject to patents or patents pending.

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Guest Editorial Cont'd. from page 86

a demand that has proved to be extremely precarious, fickle, and difficult to anticipate? One or two bitter experiences here could be extremely costly, and a new management could well decide to seek a more stable field than press building.

The prime economic factor underlying these three important transactions interests me intensely. On one hand, we have the buying companies looking for a broader base for diversification. On the other, there is a hint that, in some seasoned opinions, the machine sales peak has been reached and it is time to get out from under. Of the two motivations, the second weighs more heavily with me because I have high respect for the men who sold out, and their ability to gage business cycles and opportunities.

What about the balance of the press makers? Apart from the three new subsidiaries, there are some five major equipment makers to be considered. One is privately owned and aggressively and flexibly managed, with the injection division given a pretty free hand. A second is an old-line machine tool company where the injection machine division is not regarded as a major part of the overall picture, and progress, while good, possibly has not been as marked as at other companies. The third concern is now refinanced, semi-publicly owned, and carrying on with improvements of earlier ideas without any major concessions in design that many molders feel would greatly help advance, especially when this risk is predicated on improve their trade status.

The fourth company, which to some extent "inherited" a line of presses, has not achieved the stature possible if it had capitalized more on the available experience of the trade. Instead, this firm went back to 1938, duplicated almost all the mistakes the three leaders made in the early years, and is now undergoing a costly revision in thinking. The last company, while probably the smallest, has made good steady progress with a very limited output; never became a real competitive factor; but has never lagged too far behind the leader with respect to press performance. Of interest with these five concerns is that their activities are all centered mainly in the 6-12 ounce machine field.

Now looking ahead, it takes pretty good-sized equipment to turn out a modern 20-ounce press, and a considerable investment in parts, engineering, sales, and service to move these machines. Personally, I feel that this is where the greatest opportunity lies now, because new molds, materials, and applications have pretty well outstripped the 8- and 12-ounce classes in either mold size, plasticizing capacity, or speed and volume of production. While some jobs can and should be run on small 2-4 ounce automatics, the real opportunity for future volume and profit for press maker and molder alike, is in the fast, big, overcapacity 20-ounce machine.

Isocyanates–Their Formation, Reactions, and Applications

A discussion of the chemical fundamentals needed for an understanding of these remarkable new materials.

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The chemistry of the isocyanates is not primarily a newly-understood series of reactions with which the chemist of the day hopes to accomplish undreamed-of success; rather, most of the class reactions of the isocyanates are to be found in literature in the period between 1890 and 1920. Although common knowledge, the isocyanates did not come into their own until World War II, when the commercial exploitation of the isocyanates and their modifications by the Germans, as evidenced by patent literature and work reports, led to an almost universal desire to utilize these compounds, particularly in the field of high polymer chemistry. Examples are in the cross-linking of polymers, in obtaining adhesion to heretofore difficult-to-adhere substrata, and in the formation of new and highly desirable copolymers.

As a result of considerable research here in the United States, Du Pont National Aniline, Carwin, and Monsanto are producing isocyanates in research, pilot plant, and commercial quantities. These materials available are: tolylene diisocyanates (TDI and TDI Dimer), methylene bis 4-phenyl isocyanate (MDI), hexamethylene diisocyanate, phenyl isocyanate, octa decyl isocyanate, alpha-naphthyl isocyanate, 1,5-naphthalene diisocyanate, dianisidene diisocyanate, and triphenylmethane tri-isocyanate (TTI).

Formation of Isocyanates

Mono and diisocyanates are prepared by the reaction of aliphatic or aromatic amines with phosgene. The phosgene treatment is usually carried out in carbon tetrachloride, toluene, or chlorobenzene.

With respect to the relative reactivity of the isocyanates, it is known the aliphatics are less reactive than the aromatic materials. Even among aromatic diisocyanates, there are wide variations. Thus, for example 1,5-naphthalene diisocyanate is highly reactive, but the reactivity decreases regularly from this level in the series—nitrobiphenyldiisocyanate, tolylene diisocyanate, and hexamethylene diisocyanate. Obviously, the reactivity of the aromatic diisocyanates is dependent on the influence of substituting groups and/or the configuration of the molecule.

The toxicity of the isocyanates has been reported to be inversely proportional to the reactivity; thus, the aliphatics are generally more toxic than the aromatics. Also, in the case of the aliphatic isocyanates, the toxicity of those materials having less than eight carbon atoms in the chain is said to be very high.

Reactions of Isocyanates

In general, the isocyanates will react with all compounds which are capable of substitution by a metal or, to be more specific, compounds containing an active hydrogen atom. These include water, amines, alcohols, phenols, organic acids, amides, anhydrides, halogen acids, potassium hydroxide, sodium bisulfite, ammonia, Grignard reagents, and others. The reactions of isocyanates with sulphur-containing compounds give products analogous to oxygen-containing compounds.

A great many of the reactions may be reversed by heating. Reversal of carbamyl chlorides is the best known. These compounds have been observed to dissociate at about 100° C. Reversal has also been observed with amines, alcohols, phenol, sodium bisulphite, and active methylene compounds. This provides the advantage of blocking the reactive isocyanate group against reaction at low temperatures, then regenerating the isocyanate by heating to improve the pot-life or storage stability of isocyanate-containing materials.

The temperature at which a substituted isocyanate will dissociate depends almost entirely on the nature of the substituting group. By-product formation in the

dissociation reactions limits their use to some extent, particularly in the field of protective and decorative coatings where the formation of corrosive substances would destroy either the functionality of the coating or the substrata.

Another reaction of the isocyanates worthy of note is polymerization. Aromatic derivatives usually form dimers, whereas aliphatics give trimers. These reactions may be brought about by heat or catalysts. Those materials which function as catalysts for this reaction are: triethyl phosphenes, tertiary amines, amine hydrochlorides, Friedel-Kraft catalysts, and bases such as sodium carbonate or sodium methoxide.

Diisocyanates are particularly subject to thermo-polymerization. TDI in the presence of pyridene forms TDI Dimer which is slightly less reactive than the monomer, and by the same token less sensitive to moisture. It has been reported that the addition of phosphorus trichloride, pentachloride, or oxychloride to diisocyanates stabilizes this tendency to polymerize.

Chemical Applications

The commercial use of isocyanates and diisocyanates has dealt primarily with the formation of cross-linked polymers, adhesives, and new co-polymers with highly-desirable properties. The diisocyanates yield valuable products with a large number of hydrogen-containing substances. Typical groups containing active hydrogens include hydroxyls, carboxyls, and primary and secondary aminos. Materials of this type include diamines, polyesters, polyamides, glycols, and aldehyde condensation resins. Reactions of isocyanates with these materials can be accelerated by the use of metallic driers; i.e., tallates, octoates or naphthenates.

Polyester Modification

The modification of polyesters, if not the most interesting of the above materials for reaction with isocyanates, is the one with which most of the commercial applications have dealt. The condensation products of this sort available on the market at the present time are Goodyear's Chemigum SL and the German development, Vulcollan.

When an isocyanate is reacted with a compound that is monomeric in nature and contains only one reactive hydrogen-containing group, a simple condensation product is generally formed. If the two reactants are bifunctional, the product is polymeric, and if one of the reactants is polymeric, the product is a modified polymer of higher molecular weight.

In illustration, consider first the reaction of an isocyanate with a glycol:

$$\underset{\text{Isocyanate}}{RNCO} + \underset{\text{Glycol}}{HOR'OH} \longrightarrow \underset{\text{Hydroxy urethane}}{RNHCOOR'OH}$$

Obviously, this reaction is limited to a maximum of a two-membered condensation product of relatively low molecular weight. Now consider the reaction of a diisocyanate with a glycol, resulting in the formation of a high molecular weight polymer.

$$\underset{\text{Diisocyanate}}{nOCNRNCO} + \underset{\text{Glycol}}{nHOR'OH} \longrightarrow \underset{\text{Polyurethane}}{nOCNRNHCOOR'O[OCNHRNHCOORO]_nH}$$

The above reaction suggests the reaction of a diisocyanate with a polyester having terminal hydroxyl groups. In simple terminology, linear polyesters are formed by the reaction of a dicarboxylic acid with a glycol. This condensation reaction proceeds with the elimination of water:

$$\underset{\text{Dicarboxylic acid}}{nHOOCRCOOH} + \underset{\text{Glycol}}{nHOR'OH} \longrightarrow$$

$$\underset{\text{Polyester}}{HOOCRCOOR'O[OCRCOORO]_nH} + \underset{\text{Water}}{nH_2O}$$

The linear polyester will contain either terminal carboxyl or hydroxyl groups, depending upon whether an acid or a glycol was the last compound to react in the formation of the linear molecule. The linear compound can then be lengthened further by reaction of these hydrogen-bearing groups with a diisocyanate to a chain-extended polymer. The linkages formed by this reaction are of the urethane type in the case of terminal hydroxyl groups:

$$\underset{\text{Polyester}}{\sim\!\!\sim OH} + \underset{\text{Diisocyanate}}{OCNRNCO} + \underset{\text{Polyester}}{\sim\!\!\sim OH} \longrightarrow$$

$$\underset{\text{Polyurethane}}{\sim\!\!\sim OOCNHRNHCOO\sim\!\!\sim}$$

and principally an amide linkage in the case of terminal carboxyl groups:

$$\underset{\text{Polyester}}{\sim\!\!\sim OH} + \underset{\text{Diisocyanate}}{OCNRNCO} + \underset{\text{Polyester}}{\sim\!\!\sim OH} \longrightarrow$$

$$\underset{\text{Polyamide}}{\sim\!\!\sim OCNHRNHCO\sim\!\!\sim} + 2CO_2\uparrow$$

Since each of these linkages contain available hydrogen for reaction with more diisocyanate, it is possible to cross-link these chain-extended polymers at various points along the chain. The cross-linking or curing of these chain-extended polyesters will be discussed in detail later in this report.

In the preparation of the simple polyester, it is possible to obtain products of varying molecular weights depending in part upon the molecular weight or structure of the reactants, and in part upon the reactant number or the number of ester groups in the polyester chain. The average number of these ester groups must be held between certain limits in order to permit subsequent modification with diisocyanates to yield a product with the desired properties.

The reactant number can be determined from the average number of carboxyl and hydroxyl groups in a given amount of a linear polymer. An acid number determination gives a measure of the number of carboxyl groups in the polyester, while the hydroxyl number gives

a measure of the number of terminal hydroxyl groups. The sum of the acid and hydroxyl numbers gives the reactant number for the polyester. This figure is an indication of the average number of molecules in the mass, and the degree of polymerization. A polyester containing long-chain molecules will have a relatively low reactive number, while a polyester containing short-chain molecules will possess a high reactive number.

Polyesters can be varied by working with polyesters which consist of only one glycol and one dicarboxylic acid, or by using linear polyesters consisting of more than two components (generally known as mixed esters). Polyesters having high melting points lead to plastics which harden easily on aging, while polyesters that are liquid at low temperatures or have only moderately high melting points given polymers which do not lose their elastic properties on storage. It has been found that it is practical to work with polyesters having 50-60 hydroxyl groups with an isocyanate excess of from 30-50%.

When diisocyanates are added to bi-functional polyesters, linear polymers are formed. If, however, compounds with more than two hydrogen-containing groups are reacted with diisocyanates, high molecular weight polymers of cross-linked structure are obtained. For the purpose of simplicity, only the reaction of diisocyanates with bi-functional materials will be considered.

Vulcollan

This trade name has been broadened to include polyurethanes with elastomeric properties. The polyesters which serve as raw materials for Vulcollan products are of linear structure with free hydroxyl groups on the chain extremities. The hydroxyl content of the polyester should not vary greatly from 1.5%. This limitation necessitates the use of polyesters with an average molecular weight of from 2,100-3,100. Some of the polyesters used for preparation of Vulcollans are polyethylene adipate, poly 1,2-propylene adipate, polyethylene succinate, polyethylene sebacate, and poly 1,2-propylene succinate.

The preparation of a Vulcollan can be divided into three stages: (1) preparation of the polyester; (2) branching or chain-extending the polyester by addition of diisocyanates; and (3) final curing by the addition of water, glycols, diamines, or additional diisocyanates.

Preferentially mentioned for the formation of Vulcollan materials are polyethylene adipate and poly 1,2-propylene adipate. Variation of the raw materials and preparation methods results in a definite variation in properties. The polyester for diisocyanate modification is prepared by melting the components and raising the temperature from 160° to 220° C. to partially remove water formed within 20-40 hours, and finishing the removal of water by applying a vacuum under further heating.

Branching or chain-extending of the polyester is brought about by the addition of diisocyanate (1,5-naphthalene diisocyanate has received the most exploitation under European development). Because of the active hydrogens available on the polyester terminal hydroxyl groups, the polyesters are capable of reacting with diisocyanate to form a chain-extended polyester with urethane linkages along the chain.

The amount of diisocyanate used depends upon the number of hydroxyl groups in the polyester. Two methods for adding the diisocyanate are used; each uses about a 30% excess over an equa-molar amount based on the hydroxyl content of the polyester. With the particular polyesters used, this amounts to approximately 15-20% by weight of the charge.

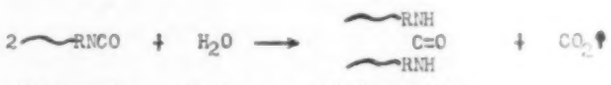
In the first method, all the diisocyanate is added at one time to the carefully dewatered polyester which has been heated to 130° C. The reaction is exothermic and is complete in a few minutes. During the reaction, the molten chain—extended polyester becomes more viscous because of increasing molecular weight, and a tendency for a secondary reaction of diisocyanate with the urethane linkages of the chain-extended polyester. This reaction product, because it contains terminal RCNO groups, must be protected from water and is thus stable for several hours.

By the second method, the carefully-dewatered polyester is heated to 130° C. and slightly less than an equivalent amount of diisocyanate (based on the hydroxyl content) is added. Again, the reaction is exothermic, but the final product, by virtue of its terminal hydroxyl groups, has unlimited moisture and storage stability. The final processing of this product will be discussed under cross linking.

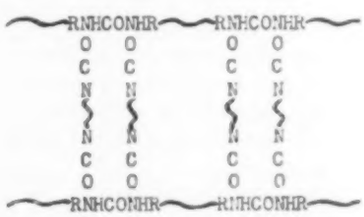
As mentioned previously, the final branching or curing of the chain-extended polyester can be effected by the addition of numerous bi-functional materials. The most commonly used are water, glycols, diamines, and additional diisocyanate.

Cross-Linking Mechanisms

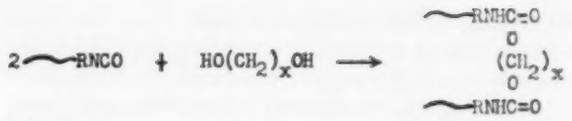
WATER: Water reacts with isocyanates to form symmetrical ureas. The addition of water to an isocyanate polyester affects first a further chain coupling by urea bridges with a simultaneous evolution of carbon dioxide:



The hydrogen atoms of the urea group are now capable of reacting in turn with isocyanate polyesters still present. This reaction leads to the formation of three dimensional supermolecules.



GLYCOLS: As would be expected, the addition of a glycol to an isocyanate polyester results in chain-lengthening, not by urea bridges but by adjacent urethane linkages:



Isocyanate Polyester | Glycol | Chain-extended Isocyanate Polyester

This stage of the reaction is associated with a certain increase in viscosity. If the proportions are so chosen that the glycol is present in either a deficiency or an amount nearly equivalent to the free isocyanate content of the isocyanate polyester, the reaction does not stop at this stage, but leads gradually through a highly viscous condition to a toally insoluble material which by further processing gives valuable rubbery products.

Similar to the water cross-linking mechanism, the linkages formed in chain coupling by the addition of glycols provide hydrogen atoms that are susceptible to reaction without isocyanate. Hence the isocyanate polyester glycol product can be cross-linked by the reaction of diisocyanate with the hydrogen atoms of the urethane linkages in the two chains.

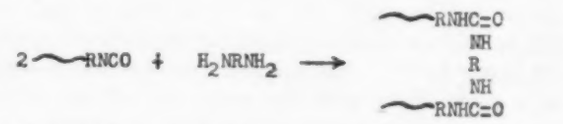
Various types of glycols can be used as cross-linking agents, including aliphatic, cycloaliphatic, aromatic and unsaturated glycols. Thus, in contrast to water cross-linking, there is an abundance of compounds which can function as cross-linking agents. Since each glycol influences the properties of the end product in some manner, it is possible to prepare products with varying properties. The amount of glycol must be so controlled that there are not enough hydroxyl groups present to be stoichiometrically equivalent to the isocyanate groups; i.e., there must always be a certain excess of isocyanate present.

Certain acidic materials may be added to the isocyanate polyester before the addition of glycol to inhibit the chain coupling reaction. Prior to application, the addition of basic materials destroys the acidic retarder and permits the glycol to function in the chain coupling reaction. With an excess of glycol, products are obtained which are thermoplastic and have high elongation. With decreasing amounts of glycol, the physical properties of the condensation product improve at first until finally, beyond a certain isocyanate content, side reactions set in.

Under certain conditions, an acceleration of the cross-linking reaction may be desired. This can be accomplished by stirring tertiary organic bases into the melt after the glycol addition. Tertiary amines such as hexahydrodimethylaniline, tribenzylamine, and tetramethyldiaminodipropyl ether are particularly useful. These catalysts are effective in concentrations as low as 0.001% by weight of the polyester. In contrast to water cross-linking, no gas formation occurs. Consequently, new and formerly unavailable rubber processing techniques are possible, such as pouring the reaction mixture into a mold, casting, etc.

AMINES: Isocyanates will react with amines to form symmetrically di-substituted ureas, the significance of which has already been discussed in the section on water cross-linking. Treatment of isocyanate polyesters with diamines results in coupling of the isocyanate polyester chains through adjacent urea groups. At the same time, the excess isocyanate groups react with the hydrogen atoms of the urea groups formed, thereby providing the cross-linking reaction. Thus, the urea group formed by diamine chain coupling furnishes the pivot point for cross-linking with diamine as well as with water.

The essential difference between the two cross-linking agents lies in the fact that with water coupling two isocyanate polyester chains are linked through one urea group in the formation of carbon dioxide, whereas the amine cross-linking proceeds by addition and two isocyanate polyester chains are coupled through two adjacent urea groups:



Isocyanate Polyester | Diamine | Chain-coupled Isocyanate Polyester

As indicated above, the use of water as a cross-linking agent involves a liberation of carbon dioxide. Although this was a problem in the very early work, it is now being used to advantage in the formation of foamed-in-place and cellular materials.

In order to obtain feasible storage stability of an isocyanate polyester, it is necessary to use less than an equal molar ratio of diisocyanate to hydroxyl content of the polyester, inasmuch as the moisture content of the resin or moisture pick-up in the atmosphere could cause chain coupling with resultant gelation. This limits the use of isocyanate polyesters with terminal RNCO groups to a two-package system.

The use of diamines as cross-linking agents for isocyanate polyester was disappointing at first, because of the high reaction rate which prevented simple processing and resulted in nonhomogeneous concentrates. The retarding reactions for glycol cross-linking were not useful here since the acidic retarders were neutralized by addition of the diamine.

Further study of this problem brought to light the fact that the reaction rate was markedly affected by the basicity of the diamine. After changing from aliphatic to aromatic diamines, it was established that compounds whose basicity is reduced by the introduction of negative substituents are particularly suitable, and 3,3′-dichlorobenzidine is an example of such a compound.

Further work showed that by means of an appropriate balance of the reactivities of the diamine and the diisocyanate, a gradual transition through the intermediate stages of the condensation is assured. This balance is easily possible, since the diisocyanates vary widely in their reactivity and the diamines vary in basicity. In direct opposition to the reactivities of the isocyanates, the aliphatic diamine compounds are very much more reactive than the aromatic. As is the case with glycol cross-linking, there is no gas formation.

A sure criterion of the reactivity between the diisocyanate and the diamine is given by the reaction velocity of the two components in boiling methylene chloride. If, on mixing half-normal solutions of the two, there is an immediate precipitate as a result of the urea formation, processing in the fluid state would be impossible if

this combination is used in the polyester system. Only with an interval of at least 25-30 seconds before the appearance of turbidity in the methylene chloride solution will processibility in the fluid state be assured. With amine cross-linking, reactive so-called bulky and open isocyanates are not required, and practically any diisocyanate can be used in combination with appropriate diamines.

Other Applications

Several other reactions of isocyanates and diisocyanates with other materials have shown considerable promise in the field of protective and decorative coatings, insulating compounds, retarding compounds, etc. The reaction of a diisocyanate with a mono-functional reactant, permits doubling the molecular weight of materials such as diglyceride drying oils, etc. These modified materials can be used in protective and decorative coatings as replacements for the more conventional compounds.

As previously mentioned, considerable work has been done along the lines of using an isocyanate-extended polyester and cross-linking with water with the subsequent liberation of carbon dioxide. The use of materials of this sort in foamed-in-place adhesives, potting materials, and sponge rubber for cushioning has opened a brand new field for isocyanate exploitation. With the advent of the use of nylon for cording material in automotive tires, the problem arose of adhering the nylon cord to the rubber carcass. The commercial use of diisocyanates to solve this problem has met with success.

Summary and Conclusions

The chemistry of isocyanates, although old knowledge, has only within the last decade been exploited to any great degree. In general, isocyanates will react with all compounds capable of substitution by a metal.

Many of the isocyanate class reactions are reversible. This permits the use of so-called isocyanate generators which on heating regenerate the isocyanate and permit its functioning as a cross-linking or chain-extending material without the problem of product stability.

When isocyanate is reacted with an active hydrogen-containing compound that is monomeric and contains only one reactive group, a simple condensation product is generally formed. If, the two reactants are bi-functional, the product is polymeric in nature and, if one of the reactants is polymeric, the product is a modified polymer of higher molecular weight. In the case of isocyanate polyesters, the linkages formed in the chain contain available hydrogen for reaction with more diisocyanate which permit cross-linking of the chain-extended polymer at various points along the chain. This reaction permits the formation of highly cross-linked materials which by their nature are insoluble and unfusible.

In the formation of an isocyanate polyester, certain limits must be adhered to with respect to hydroxyl group content acid number and the degree of polymerization to fit the formation of a rubbery material. It has been found practical to work with polyesters having 50-60 hydroxyl groups with an isocyanate excess of from 30-50%. The reaction of isocyanates with polyesters is the one that has received the most attention from a commercial standpoint.

When water is used as the cross-linking agent, carbon dioxide is liberated as a by-product. This phenomena can be used to advantage in the formation of sponge-like materials, foamed-in-place insulation, etc. With the use of glycols or diamines as cross-linking agents, no gas formation takes place. By a judicious use of various diisocyanates, or glycols, or diamines or retarding agents, the final properties of the end product can be varied to suit the requirements.

From the evidence to date, it appears that the isocyanates and diisocyanates can be valuable building blocks in the hands of the organic chemist for the formation of new copolymers with highly desirable properties, in the cross-linking of available polymers, and in obtaining adhesion to heretofore difficult-to-adhere substrata.

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News of the Societies

AIEE Automation Conference

"Automation in the Rubber and Plastics Industries" will be the theme of a two-day conference sponsored by the American Institute of Electrical Engineers' Subcommittee on Rubber and Plastics Industries of the Committee on General Industry Applications. The seventh such conference, it will be held at the Mayflower Hotel, Akron, O., April 4 and 5.

The following is a tentative schedule of events:

MONDAY, APRIL 4

"What Does Automation Mean to a Processing Industry?", Everett S. Lee, General Electric Co.

"The Status of Automation in the Rubber and Plastics Industries," G. V. Kullgren, Hale & Kullgren, Inc.

"Electric Drives for Rayon and Nylon Tire Fabric Machines," C. E. Robinson, Reliance Electric Co.

"Comparison of Continuous Thickness Measuring Systems," R. F. Snyder, Goodyear Tire & Rubber Co.

"Automatic Weighing Systems—a Symposium," A. G. Payne, Monsanto Chemical Co.; R. V. Fisch, The Ohio Rubber Co.; R. E. Bell, Toledo Scale Co.; J. C. Williams, Jr., Weighing Components, Inc.; and W. M. Young, Richardson Scale Co.

Banquet. (Speaker to be announced.)

TUESDAY, APRIL 5

"Comparison of Electronic, Rotating Regulators and Magnetic Amplifiers," J. P. Montgomery, Westinghouse Electric Co.

"Report of Special Committee on Electrical Equipment in Contaminated Atmospheres," Edwin L. Smith, Firestone Tire & Rubber Co.

"Application and Design Considerations of A.C. Motors in Rubber and Plastics Industries," C. E. Miller, General Electric Co.

"Automatic Control Centers for Industrial Processing," Paul Dickey, Bailey Meter Co.

Inspection Trip to Timken Roller Bearing Co., Canton, O.

Chairman of the local arrangements committee for the conference is R. D. Heyburn, 479 Champlain St., Akron 6, O. W. S. Watkins, The Ohio Rubber Co., Willoughby, O., is chairman of the subcommittee on rubber and plastics industries.

SPE-SPI Joint Meeting

The Southern California Section, SPE, met jointly with the Pacific Coast Section, SPI, on January 20 at Scully's Restaurant, Los Angeles, Calif. Over 160 members and guests attended the meeting, which was presided over by W. Dewar of Standard Plastics.

W. E. Donaldson, U. S. Naval Ordnance Test Station, Inyokern, Calif., addressed the audience on "Plastic Materials in Naval Ordnance." His presentation included motion pictures of the launching of a B-4 track sled for rocket testing, and the fabrication of a laminated plastic rocket motor tube. Mr. Donaldson also discussed various plastics problems in Naval Ordnance testing, illustrating his talk with samples of molded and fabricated plastic parts.

Reinforced Plastics Forum

An address on the advantages of reinforced plastics in the aircraft industry, and a panel discussion on Fiberglas, featured the January 10 dinner meeting of the Southern Section, SPE, held in Atlanta, Ga.

C. F. Marschner, Lockheed Aircraft Corp., addressed the 45 members and guests on the high strength-to-weight ratio, corrosion resistance, and weatherability, electrical properties, and ease of producing intricate shapes with reinforced plastics. He also cited the aircraft industry's need for a reinforcement to provide greater elongation, higher stress-strain ratio, greater uniformity of properties in all directions, and standardization of properties.

W. M. Keller, M. T. Nemeyer, J. W. Dougherty, and George Hammond, all of Owens-Corning Fiberglas Corp., formed a panel for discussion and a question-and-answer forum on Fiberglas, describing the manufacturing processes and applications of this reinforcing material.

Officers of the Section for the coming year were announced as follows: president, Leo J. Diamond, Koppers Co.; vice president, G. E. Ballentine, Scripto, Inc.; secretary, Bradford L. Nicholson, manufacturers' representative; and treasurer, C. Veazey LeCraw, Lockheed Aircraft Corp.

Buffalo Section Tours GM Plant

Members of the Buffalo Section, SPE, were guests of General Motors' Harrison Radiator Division plant in West Lockport, N. Y., on January 14. Following dinner in the foremen's dining room, the group was conducted on a 2½-hour tour of the plant which is considered a prime example of automation.

Although not directly pertinent to the plastics field, an analysis of the mass production steps revealed many techniques which could be applied to plastics production. Mr. Howe, general manager, pointed out that the plant produced 16,000 radiators daily, supplying all of General Motors' divisions plus other customers.

Injection Machines Discussed

The New York Section held their regul monthly dinner meeting February 16th the Gotham Hotel, with president Palmer Humphrey, R. C. Molding, Inc presiding. Approximately 84 members an guests were in attendance to hear A. Morse, president of Injection Molders Sup ply Co., discuss "Thermocouple Locati in the Injection Molding Machine Heati Cylinder," and David J. Sloane, vice-pres dent of Lester-Phoenix, Inc., speak o "Specifications and Standards on Injecti Molding Machines." Both speakers illu trated their talks with film slides.

Mr. Morse's discussion basically in volved the problems of molding the ne improved compounds on what might b termed obsolete equipment. Molders ha found that the evolution of high quali compounds has narrowed the gap betwee proper molding temperatures and decom position temperatures of the materials use The answer, implied by Mr. Morse, seem to lie in increased instrumentation as ap plied to the heating cylinders. Specia emphasis on having heaters adapted t individual injection molding machines, a cording to Mr. Morse, would provide uni form and completely controlled heating t reduce the dangers of decomposition.

Mr. Sloane spoke on the advantages an difficulties of achieving standards pertain ing to injection machines. Plasticizing ca pacities and clamping pressure future stand ards were just two of the more importan matters aired. Mr. Sloane expressed th hope that interchangeable mold clamp that will fit any comparable injection ma chine will soon be a reality.

With the completion of Mr. Sloane talk, questions were received from th general membership.

Because of the subjects involved, com mittee reports in the business session preceding the talks were held to a mini mum. Arthur S. Jacobs, Augusta Plastics Inc., briefly outlined the chapter's intensi fied membership drive. Also announced were the Section's new monthly newsletter and the imminent formation of a vacuum forming group.

A door prize donated by Monsanto Chemical Co. was won by Mr. Jacobs.

Canadian Chemical Conference

More than 700 chemists and chemical engineers are expected to attend the 38th annual conference of The Chemical Institute of Canada in Quebec, Que. This occasion marks the tenth anniversary of the Institute's founding.

Featured this year are two special ad dresses by prominent scientists, and the awarding of the Institute's medal to an out standing chemist. Approximately 100 papers will be presented by authorities on agricultural chemistry, analytical chemistry, biochemistry, chemical education, chemical engineering, organic and physical chemistry, and protective coatings.

Maurice Lessard, chairman of the con ference committee, has arranged many spe cial events for the delegates, including plant tours through local industry, and to the Saguenay area.

Talks on Nylon and Materials

Approximately 100 members and guests attended the February 9 meeting of the Newark Section, SPE, held at the Military Park Hotel, Newark, N. J. "Recent Developments in Nylon" was the topic of an address by W. C. Wall, E. I. du Pont de Nemours & Co., and J. H. DuBois, Mycalex Corp. of America, spoke on "Material Selection Considerations."

Mechanical applications of molded nylon in the manufacture of non-friction gears and bearings were discussed by Mr. Wall. In a succession of slides he pointed out that nylon was utilized in such diverse fields as textile machinery, refrigerators, elevator rails, and airplane and medical instruments. The number of nylon parts possible in a complex mechanism is practically legion, 54 being used in a new fare counter for buses. One difficulty mentioned was that fillers cannot be used with nylon, since they tend to separate in the melt.

Special properties of plastic materials have greatest value when efficiently used in the overall product design, according to Mr. DuBois. In electrical applications materials are available for individualized problems such as high voltage, frequency, and current arcs; semi-conductors; permeability cores; anti-static capacitors; high and low temperatures; and corona insulation stability. He further stressed the fact that no plastic possessed total dimensional stability, and the wrong material is always the most costly.

A discussion period followed the talks and door prizes donated by Lionel Corp., Industrial Synthetics Corp., Newark Die Co., and Natvar Corp., were presented.

Plastic Parts Finishing Panel

"Finishing of Plastic Parts" was the subject of a three-man panel at the February 2 meeting of the Western New England Section, SPE, held at Bradley Field, Windsor Locks, Conn.

Charles W. Bentley, Colt's Mfg. Co., introduced the topic with the statement that finishing is probably the most important phase of the whole molding operation, and in end-use items accounts for up to 60% of direct labor costs.

James Dunn, C. F. Church Co., described the complex finishing operations required for the production of plastic toilet seats, stressing the cost problems involved.

Herbert Hasenzahl, Pro-phy-lac-tic Brush Co., spoke on cementing of the finished part, discussing equipment, processes, and techniques for producing and testing an air-tight cemented joint. He also touched on the subject of vapor blasting and nickel-silver inserts.

The question-and-answer session which followed brought up discussions on automatic finishing, deflashing of nylon, definning polyethylene and molded vinyl, tapping, dipping, edge finishing, and production of satin or sand-blasted finishes.

Following the forum, a colored movie on "New Welding Techniques" was shown to the 73 members and guests by Arthur W. Logozzo, Nutmeg Chrome Corp.

Finishing Reinforced Plastics

Pre- and post-finishing of reinforced plastics parts were subjects of a forum discussion held by the SPE New York Section's Reinforced Plastics Group, February 23, at McGinnis' Restaurant, Jamaica, N. Y. More than 60 members and guests attended the meeting, over which L. Wittman, L. Wittman Co., presided as moderator.

Harry Friedman, Russell Reinforced Plastics Co., introduced the topic with a general discussion of molds and resins, stressing the fact that resin viscosity control is of pirme importance in obtaining a smooth surface on the laminate. The use of fillers such as 116 and 128 cloth, 10-mil glass surfacing mat, and non-milled cotton and rayon, were also described.

J. Stanley Bowen, Lunn Laminates, Inc., spoke on pre-finishing, emphasizing the need for a parting agent to obtain a smooth surface, although such agents dull the finish gloss and necessitate subsequent buffing. He also discussed the use of overlap or veils, fiber-woven sheets, unsized papers, and felts.

Advantages and disadvantages of gel coats and pigmented, filled laminates were outlined by D. K. Bickel, Glidden Co. Surface preparation and priming for post-finishing are necessary before application of a top coat. He felt that non-conventional, catalyzed finishes, especially the epoxy based coatings, offer more promise than conventional alkyds, vinyls, and lacquers.

Cleveland -Akron Section Meets

Hugo Becker, Crucible Steel Co., addressed the regular monthly meeting of the SPE Cleveland-Akron Section, February 14 at the Spanish Tavern, Brecksville, O., on the topic of "Tool Steel for Plastic Molds." He emphasized that the application of the mold determined the choice of tool steel used. The type and condition of the material to be worked, number of pieces to be produced, methods, and condition of the equipment are all contributing factors.

Officers of the Section for 1955 were announced as follows: president, Sherman W. Crawford, Detroit Mold Engineering Corp.; vice president, Granville H. Shirley, Colonial Plastics Mfg. Co.; secretary-treasurer, Herbert D. Oliver, Eastman Chemical Products, Inc.; and national director, Ernest Moslo, Moslo Machinery Co.

Automatic Molding Discussed

The regular meeting of the Connecticut section, SPE, took place February 11, in Bridgeport, Conn. Approximately 45 members attended, and were addressed by Quentin White, F. J. Stokes Machine Co., Philadelphia, Pa., on the subject of "Automatic Molding."

Mr. Stokes traced the history and development of automatic compression and injection molding of plastic materials. He also described in detail the company's 4-ounce automatic injection press.

Southern Section Hears Dawson

Acrylic plastics were the subjects of discussion at the February 21 meeting of the SPE Southern Section, Atlanta, Ga. Following a reading of reports from the membership, program, and project committees, Robert Dawson, Rohm & Haas Co., discussed the physical and chemical properties of acrylics from the designer's point of view. Optical properties were particularly stressed, and the fifty members and guests were shown specially designed parts illustrating applications for piping, bending, and reflecting of light. Lenses, dials, edge-lighted panels, horn buttons, name plates, and other decorative items were among the samples on demonstration.

Chicago SPE-SPI Joint Meeting

The SPE Chicago Section and the Midwest Chapter, SPI, held a joint meeting on January 19 at the Western Society of Engineers' Dining Room, Chicago, Ill. Howard H. Irvin, Marbon Corp., addressed the 115 members attending on "Cycolac, A new High-Impact Plastic."

A blend of styrene, butadiene, and acrylonitrile, Cycolac has the lowest gravity of any rigid thermoplastic on the market, according to Mr. Irvin, and its strength/weight ratio is exceeded only by nylon. The brittle point is reportedly below —45° C., and electrical properties show practically no change over broad frequency and temperature ranges.

As an injection molding material, Cycolac is said to impart high surface hardness and gloss. Its high tensile and burst strength should make it an ideal material for the extrusion of plastic pipe, Mr. Irvin added, and its low coefficient of friction indicates promise as a bearing material. Cycolac can be machined and joined by conventional methods, and, in sheets, is suitable for vacuum forming.

Industrial Engineering Techniques

S. M. Block, lecturer in Industrial Engineering at the University of Minnesota, addressed SPE's Upper Midwest Section at their January 21 meeting in Minneapolis, Minn. Forty-one members and guests attended the meeting.

The topic of Mr. Block's talk was "Three for the Money", and he outlined three factors as vital for business growth: quality products, fast service, and low prices. Applying industrial engineering techniques such as quality control elevates the quality of products, which are primarily dependent on good design, material selection, tooling, and production procedures.

Fast service can be costly if based on excess machine capacity and manpower; however, an effective production control system can facilitate order completion with less pressure on the production department. Among the frequently neglected factors for reducing overhead, and subsequently prices, are work simplification and work measurement analysis. These and other analytical methods can contribute to overall business growth, Mr. Block said.

Cont'd on page 117

NEWS of the INDUSTRY

Rollway Roller Bearing Increases Load Capacity of Extruder

A specially-engineered thrust roller bearing, supporting a top load rating of 114,500 pounds at 67 rpm., has enabled the transmission of a 4½-inch extruder, manufactured by National Rubber Machinery Co., to handle a variety of extrusion loadings and materials, including rubber and plastics, according to Rollway Bearing Co., Syracuse, N. Y., makers of the bearing.

Although the general dimensions of the new bearing necessarily remained the same as those of the standard bearing previously used, the roller complement was altered completely. Roller diameters were increased by ¼-inch, making the roller one-third larger than those of regular thrust roller bearings of similar over-all dimensions. Roller slots were widened, lengthened, and their number decreased to give a greater projected roller surface between the bearing plates.

According to Rollway, its radial bearings support and locate the extruder transmission's three gear shafts. The high-speed shaft bearings and the intermediate speed shaft bearings are steel cage type metric series bearings. Completely separable, they are of the floating type, having been press-fitted to the shaft and slip-fitted to the transmission housing.

Bedford-Bolling Incorporates

Bedford-Bolling Co. has been incorporated to facilitate its new expansion program which includes the assumption of the used machinery business and some of the specialties of its parent company, Stewart Bolling & Co., Inc., Cleveland, O., manufacturers of rubber and plastic machinery. Stewart Norris Bolling, Stewart Bolling, and Edward Butler are the incorporators and administrators. A new plant is being built in Bedford, O.

Goodyear Installs Five Heavy Reinforced Plastic Presses

Presses ranging in size from 100-700 tons have been installed by Goodyear Aircraft Corp., Akron, O., for the production of plastic canopies and laminates. Reportedly the largest facility for mass production of reinforced plastics items, the plant will manufacture automobile bodies, boats, fuel tanks, packaging cases, missile and aircraft parts, and farm equipment.

The five presses include one 100-ton, one 700-ton, and three 300-ton units, all hydraulically operated. Together with supplemental machinery, such as preformers, ovens, mixers, and a grinding booth, the equipment required a year to install.

First job for the 700-ton press, said to be the largest of its kind, is the production of one-piece hulls for outboard boats, to be marketed by Bowman, Inc., Little Rock, Ark. Goodyear has been producing optically-clear canopies and a number of reinforced plastics products since 1945.

Battery of Reinforced Plastics Presses at Goodyear Aircraft Plant.

Scott Testers' New Spartanburg Plant

Scott Testers Opens New Plant

Scott Testers (Southern), Inc., the southern repair and service center for equipment manufactured by Scott Testers, Inc., Providence, R. I., has erected a new plant in Spartanburg, S. C. Parts will be stocked, and a staff of factory-trained service personnel will be available for repair work at the plants using Scott machinery.

John E. Hargreaves will serve as general manager of the Spartanburg plant, and John Klinck will continue as sales representative for Scott Testers in the area.

Spencer Plant Tested

Spencer Chemical Co., Kansas City, Mo., has announced completion of its test-run production of polyethylene at the new plant in Orange, Tex. The plant was designed by Spencer's engineering department, built by Quaker Valley constructors, a wholly-owned subsidiary, and completed well under the original cost estimate made in 1953.

In the initial run, conditions of operation were varied to produce several satisfactory grades of polyethylene. The operating section was placed in automatic control within 15 minutes after production had been started. The trial run was operated at approximately 80% of designed capacity.

Subsequent laboratory tests indicated that the initial product meets all requirements of commercial specification. Process information for design of the new facility was obtained from Imperial Chemical Industries of England, which supplied experienced observers and consultants.

Thicker PVC Sheets Available

Calendered rigid vinyl sheets which make possible deep-drawn vacuum formed parts have been developed by Bakelite Co., New York, N. Y. Available in thicknesses up to 0.040-inch and widths up to 51½ inches, the sheets are marketed in continuous or custom-cut lengths, and in a wide range of colors.

Surfaces comparable to those of press-matted products are reportedly possible. Improved light stability makes the new sheeting a preferred material for new types of lighting fixtures, according to Bakelite. Current tests are said to show no change in light transmission values after 150,000 hours of continuous exposure to fluorescent light.

Other applications include deep-drawn can liners, and vacuum formed, three-dimensional advertising displays. Complex shapes have been formed with as little as eight seconds preheat time.

American Resinous Remodels

American Resinous Chemicals Corp., Peabody, Mass., has completed an extensive remodeling of its laboratories, including the installation of major work areas for resin and plastic emulsions, solutions, and hot melts; a constant temperature room: space for solvent adhesives and coatings, containing pilot plant processing and churning equipment; and sample and conference rooms.

Special equipment has been made available for testing resistance to aging, oxidation, and sunlight, as required for coatings of fabric and paper, as well as equipment for tensile and shear tests on adhesives.

Vapor Barrier Proves Success

More than 5½-million square feet of Koroseal flexible vinyl have gone into industrial roof construction as a fire-retardant barrier, according to the industrial products division, B. F. Goodrich Co., Akron, O.

The new roof, developed by Lexsuco, Inc., Cleveland, O., utilizes a "vapor barrier" which prevents drippage of inflammable asphalt or tar that can accelerate the growth and add to the seriousness of industrial fires.

Announced only a year ago, Lexsuco-type roofs have been installed by many of the nation's leading industrial firms, and holds promise for use in schools, public and private buildings, and flat-top homes.

Witco Acquires Emulsol

Witco Chemical Co., New York, N. Y., has purchased the chemical division of Emulsol Corp., Chicago, Ill., and has organized it into Emulsol Chemical Corp. to continue production of its chemical line. Benjamin R. Harris will continue as president of Emulsol, and Solomon Epstein will remain as executive vice persident. No changes in company personnel or policy are anticipated.

Witco, in its 35th year, operates 12 wholly-owned or associated plants and 10 sales offices in the United States, as well as one plant and two sales offices in England. These facilities will become available to Emulsol to enable it to expand its activities in this country and abroad, Witco says.

Du Pont Opens New Sales Service Laboratory

A new, modern sales service laboratory was officially opened on February 14 by the Polychemicals Department of E. I. du Pont de Nemours & Co. at Chestnut Run, near Wilmington, Del. In addition to work on plastics, the laboratory will service many of the department's industrial and agricultural products.

The new $3 million dollar installation is a modern brick building with some 62,000 square feet of floor space. According to E. F. Schumacher, Polychemicals sales director, the laboratory will have two primary objectives: (1) assistance to customers on service problems; and (2) development work on new materials and processes. Plastic materials are new materials, Mr. Schumacher said, and much of the work of the new laboratory will be the education of users on sound engineering and design practices for plastics.

In organization, the laboratory is divided into five functional groups: molding; extrusion; general products and testing (includes non-plastic products); application design; staff; and training. Varieties in both sizes and types of processing equipment are contained in the molding and extrusion sections. Injection machines range from 1-16 ounces in capacity, while extruders are available in sizes from 1¼-4½ inches. Facilities are also available for compounding and forming of the company's thermoplastic materials.

The laboratory also functions as a showcase for Du Pont's plastic materials, since many structural, mechanical, and decorative parts were fabricated of Alathon polyethylene, Lucite acrylic resin, Teflon tetrafluoroethylene, and Zytel nylon. Alathon is used for laboratory ware, exhaust ducts, vent pipes, and cable jackets and insulations. Lucite letters were used for the laboratory sign on the building facade, and the plastic was employed in the prismatic lighting panels for the office and conference sections, and in the laminated wall panels of the reception area. Teflon packings are used in the boiler feed pumps and the air conditioning control valves. Zytel applications include door hinge bushings; gears for venetian blinds; refrigerator door lock and shelf rollers; bearing pads for desk drawers; cams, bushings, and gears for typewriters and calculators; and others.

Other Du Pont plastic materials are also represented in the laboratory. These include Butacite polyvinyl butyral interlayers in laboratory hood safety glass; Dacron polyester fiber reinforcement for fan V-belts; Hypalon chlorosulfonated polyethylene rubber floor tile; and Mylar polyester film wall tile covering.

The new laboratory will be staffed by about 100 persons, and is under the supervision of D. B. Hanson. H. S. Lecky, sales service manager, is in charge of the facility which is another segment of Du Pont's expanding research center at Chestnut Run.

View of Laboratory Lobby Shows Lucite Ceiling Panels, Hypalon Floor Tiles, Lucite-Faced Wall Panels (left), and Mylar-Surfaced Wall Tile (right).

Entrance to Du Pont Polychemicals' New Sales Service Laboratory.

View of Injection Molding Section in New Du Pont Laboratory.

Dow Forms Dutch Subsidiary

Permission has been granted Dow Chemical Co., Midland, Mich., to establish a wholly-owned subsidiary company, which will be known as Nederlandsche Dow Maatschappij N. V., Rotterdam, Netherlands. The new company is permitted to import, manufacture, and distribute magnesium and a variety of chemicals and plastics, both domestically and abroad.

Plans are being laid for the construction of a manufacturing plant, tank storage, warehouse, and dock facilities on a 50-acre tract in the Third Petroleum Harbor at Rotterdam. The harbor is now being completed by the Port of Rotterdam, and construction on the plant site is expected to begin about mid-1955.

Among the products the firm plans to process are polystyrenes, magnesium alloys, and glycols. All sales for the Dutch company, both in The Netherlands and abroad, will be handled by two other wholly-owned subsidiaries, Dow Chemical International, Ltd., and Dow Chemical Inter-American, Ltd., with branch offices and sales representatives throughout the world.

The board of directors has been appointed as follows: Chairman H. L. Wolterson, Dutch industrialist and banker; Clayton S. Shoemaker, president of Dow Chemical International, Ltd.; W. Tyrone Gillespie, assistant to the president of Dow Chemical; Oliver E. Beutel, traffic manager of Dow's Texas division; and Theodore E. Knapp, manager of Dow Chemical International's office at Zurich, Switzerland.

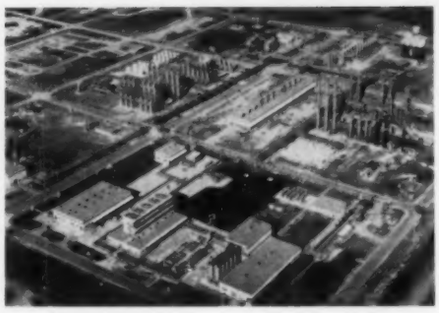
Battelle Installs Gamma Source

As part of an expanding program of molecular energy research for industry, Battelle Institute, Columbus, O., is installing one of the country's largest gamma radiation sources for activating or "triggering" chemical reactions. Initially the source will consist of 2,000 curies of cobalt-60, with an ultimate planned capacity of 10,000.

The source was to be available for contract studies about February 15, and it is expected that a wide variety of organic materials can be polymerized with radiation at low temperatures and pressures. Polyethylene and polystyrene have already been made in this fashion, and Battelle hopes to produce entirely new polymers through radiation-activated reactions.

Cross linkages of long-chain molecules like plastics and rubber have been effected by radiation. In the case of rubber this formation is known as vulcanization, and is accomplished by the addition of sulfur-containing compounds to the rubber. By irradiation it appears possible to vulcanize rubber without the addition of sulfur compounds.

Cross linkages are also produced when previously polymerized plastics are irradiated, according to Battelle, and physical properties are modified. The softening point, particularly in the case of polyethylene, is raised and the solubility in organic solvents decreases.



New Carbide & Carbon Chemicals Plant at Seadrift, Tex.

Union Carbide Opens New Plant

A new chemical plant at Seadrift, Tex., has begun full-scale production of polyethylene, butadiene, and ethylene oxide. The installation was built and will be operated by Carbide & Carbon Chemicals Co., a division of Union Carbide & Carbon Corp., New York, N. Y. Processing and sales of polyethylene will be handled by Bakelite Co., another division of the Corporation.

The Seadrift unit, which reportedly will increase the industry's output of polyethylene by more than 25%, has a rated capacity of 60 million pounds. Representing the fifth in a series of plants which will synthesize ethylene oxide from ethylene, it is the third Union Carbide facility also to produce polyethylene.

Ethylene oxide has become one of the major raw materials in the chemical processing industry. Produced by a direct oxidation process developed by Carbide in 1937, it is the essential ingredient of ethylene glycol which is used in the manufacture of anti-freeze and low-freezing dynamite, and as a moistening agent for cellophane.

A sixth plant for the production of ethylene oxide is currently under construction at Torrance, Calif. Scheduled for completion early in 1956, it will also manufacture polyethylene.

Eli Lilly Changes to PVC Pipe

PVC piping with injection molded screw fittings now replaces carbon steel at the Eli Lilly drug manufacturing plant in Indianapolis, Ind. Produced by Tube Turns Plastics, Inc., Louisville, Ky., the pipe is said to overcome a number of corrosion problems with subsequent reduced maintenance costs.

PVC vacuum lines have been installed on vessels used to precipitate ether, thus eliminating the corrosive action of moisture and sweating. As a drainage system for spent hydrochloric, sulfuric, and other mineral acids, the pipe has an indefinite life as opposed to carbon steel which required replacement every eight months.

Inert and non-toxic, the pipe contributes to the maintenance of the high quality required of a drug manufacturer. The fittings were made by the Hendry process of injection molding, and are said to be stronger than PVC fittings made by conventional compression molding processes on a strength-to-weight basis.

Materials Handling Conference

"The Concept of Obsolescence" will be the theme of a three-day conference on new methods of materials handling to keep up with the increasing automation of industrial plants, which is to be presented by the American Material Handling Society at the International Amphitheatre, Chicago, Ill., May 16-18, according to Clapp & Poliak, Inc., New York, N. Y., founder and producer of the event, which has made a grant to the Society to underwrite the conference's expenses.

The conference will coincide with the 6th National Materials Handling Exposition, May 16-20, also to be held at the International Amphitheatre. The show, said to be one of the largest in the country, will demonstrate all types of materials handling equipment under simulated factory conditions. More than 200 companies will exhibit.

In addition to discussing the latest systems and types of equipment for handling materials in the newest automation-adjusted plants, the conference will deal with the handling problems of older plants which cannot move from their present sites.

Topics to be discussed cover the wide range of cost reduction; effect of handling on production problems; receiving; warehousing; shipping; containers; palletization; storage patterns; loading and unloading facilities; purchase, leasing, replacement and maintenance policies; analysis of materials handling problems and its relationship to layout and production; water, rail and over-the-road carriers, and yard handling.

Expect Greater Demand for Plastic Housewares in 1955

Molder ingenuity and effective merchandising should increase the consumption of plastic housewares in 1955 by about 14%, predicted R. C. Evans, director of marketing, plastics division, Monsanto Chemical Co., Springfield, Mass., at the National Housewares and Home Appliance Exhibit in Chicago, Ill., in January.

He further stated that new variations in styrene molding compounds and greater polyethylene supply would be primarily responsible for an estimated rise in consumption of 12-million pounds over 1954's 88-million total.

Dollar volume at retail level should be about $200 million, according to Mr. Evans, and polyethylene sales are expected to account for much of the increase.

Michigan Molded Plastics—St. Regis Paper to Exchange Stock

Majority stockholders of Michigan Molded Plastics, Inc., Dexter, Mich., have signed agreements with St. Regis Paper Co., New York, N. Y., granting St. Regis options to acquire their capital shares in exchange for shares of St. Regis common stock.

Michigan Molded Plastics manufactures compression and injection molded plastic parts for the automotive, appliance, ordnance, and other industrial fields.

Visking Opens Flemington Plant

A new plant for the production of Visqueen polyethylene film has been opened in Flemington, N. J., by Visking Corp., Terre Haute, Ind. Occupying a 20-acre site and representing an investment of over $1 million, the Flemington installation represents another link in a projected coast-to-coast operation.

The unit will initially employ 60-80 workers, and will be serviced by a private railroad siding. All plastic film plants are under the management of E. B. Cahn, with headquarters in Terre Haute. The new plant will be under the direction of Charles H. Molitor.

Applications for Visqueen include insulation and protective coatings, as well as drum and carton liners, food packaging, and reusable wraps for soft goods.

New Visking Plant in Flemington, N. J.

Shifts to Plastic Insulation

Complete conversion from the manufacture of rubber insulated wire to plastic insulated wire and lacquered braid at Holyoke Wire & Cable Corp., Holyoke, Mass., is expected to be completed within the next few months, according to the 44-year-old firm. As recently as 1945, Holyoke was devoting 75% of the floor-space in its extrusion department to the production of rubber-coated wire.

Michael Andrews, president of the company, gives the sudden shift in consumer demand as the reason for the conversion. In 1945, plastic extrusion at Holyoke was limited to two extruders operating during a single eight-hour period. Conversion plans were considered soon after when orders for plastic insulated wire began to boom with the simultaneous falling off of orders for rubberized wire, and work on the project was begun early last year.

A new plastics mixing department will occupy one end of the plant, with all equipment arranged for straight-line production to the shipping department at the other end. Rubber insulating equipment of all types have been disposed of. In addition, many new braiders and spindles for lacquered insulation have been added to meet the increasing demand for this high-temperature material.

Currently, Holyoke is manufacturing a complete line of hook-up wires with vinyl, polyethylene, Rulan, and nylon plastic insulations to various government specifications, and to Underwriters' Laboratories and Canadian Standards Association requirements. Cable assemblies and harnesses are made up to customer specifications. Kel-F and Teflon insulation is expected to be supplied shortly.

Design Engineering Exposition

The first comprehensive exposition and technical conference devoted to the problems of design engineers will take place at Convention Hall, Philadelphia, Pa., May 31 to June 3, according to Clapp & Poliak, Inc., originators and producers of the affair. Called the Design Engineering Show, the exposition will be the successor to the Basic Materials Exposition previously held in New York and Chicago.

Purpose of the four-day show is to assist design engineers in striking a harmonious balance between the need for reducing manufacturing costs of consumers goods, and the unflagging demand for cheaper, more functional, and more attractive products, the management firm says.

Featured along with basic materials will be the mechanical, electrical, hydraulic, and pneumatic components of end-products, finishes, coatings, and other parts, shapes and forms. Design engineers from all over the world are expected to attend. Exhibits will be supervised by engineering executives from the major suppliers to the original equipment market.

Heading the board of sponsors for the events is Don G. Mitchell, chairman of the board of Sylvania Electric Products, Inc. Advance registration cards and information about the conference may be obtained from Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

Annual Packaging Conference and Exhibition Scheduled for April 18-21

Opportunities for increased sales appeal and reduced costs in consumer and industrial packing will be emphasized at the three-day national meeting of the American Management Association, scheduled for April 18-20 at the Palmer House, Chicago, Ill. The full program will include discussions of packaging materials, machinery, testing equipment, shipping, and traffic management, with as many as six groups in session simultaneously.

More than 1,000 packaging, traffic, and materials handling executives and technicians are expected to attend the conference, one of a dozen national meetings sponsored annually by the Association. Foam and expandable plastics together with their present and potential applications will be described. Two large chemical companies will outline their methods of bulk packaging.

In conjunction with the conference, the 20,000-member Association will also conduct its 24th National Packaging Exposition on April 18-21 at the International Amphitheatre in Chicago. One of the largest and most colorful trade shows, the exposition will feature the newest products and services for $10-billion-a-year packaging industry.

Some 30,000 users of packaging materials, equipment, and services are expected to attend the show which will occupy an area of 140,000 square feet. Approximately 375 exhibitors will participate in making this show one of the largest on record.

Vinyl-Insulated Heating Tape for Hothouse Beds Being Installed.

Embedded Plastic Coated Wiring Heats Hotbeds Electrically

Strips of plastic coated electric wire connected to a thermostat and buried in the soil, are said to furnish an inexpensive method of "forcing" early growth of seedlings. Called Line-O-Heat, the tape type lineal heater is manufactured by Smith-Gates Corp., Plainville, Conn.

Line-O-Heat is made by spiraling a heater wire on a fibrous glass core and covering with a double-reverse wrap also of fibrous glass. The assembly is then insulated with a high-temperature vinyl plastic jacket of B. F. Goodrich's Geon. This is said to insure moisture resistance and low temperature flexibility.

For best results, the lineal heater should be buried approximately six inches below the intended soil level. A layer of wire screening, ¼- or ½-inch mesh, should be placed over the heating tape before adding the remainder of the soil to prevent possible damage by cultivating tools. Experiments indicate satisfactory results obtained with seed sown directly in the ground. Here, the depth varies with the type of plant. Frost protection may be effected by laying the tape along the rows of plants and covering with dirt at intervals.

The heater is available in lengths of 3, 6, 12, 20, 40, and 60 feet. An electrical rating of five watts per foot of length is standard. Adjustable thermostats maintain the soil heat at any desired temperature between 50 and 90° F., which is the range of useful temperatures for all growing plants.

Says New Markets Needed

Business must aggressively create new markets with new and better products if the economy is to show more than modest gains over 1954, according to Leland I. Doan, president of Dow Chemical Co., Midland, Mich., in a year-end statement. Noting that the nation's economic readjustment appeared to have run its course and government spending has approximately leveled off, he predicted a marginally better year for Dow and for business generally. He cited plastics, agricultural chemicals, and magnesium as lines which looked especially promising.

$291,000 for Science Education Du Pont's 1955-56 Aid Program

A fund of $291,000 for grants to universities and colleges to encourage the teaching of science and mathematics has been announced by E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., as part of its $800,000 aid-to-education program for 1955-56.

The fund includes $75,000 for summer and winter fellowships for master's degree training for high school science and mathematics teachers; $125,000 to advance the teaching of chemistry in 50 privately-supported institutions, mostly liberal arts colleges; and $91,000 for 24 postgraduate teaching assistantships in chemistry.

The grants for better teaching were introduced in recognition of a growing need for such assistance, and were worked out in cooperation with educators throughout the nation, du Pont reveals. More than 100 institutions will be beneficiaries in the next academic year of these teaching grants. In the past, the grants have been of an experimental nature, but are now the largest part of the company's aid-to-education program.

This full program also encompasses the granting of $279,000 for fundamental research, $210,000 for postgraduate fellowships in science and engineering, and the balance for miscellaneous functions. The 1955-56 figure of $800,000 is an increase of $100,000 over the previous period's donations.

Included in the authorization for research are grants-in-aid of $15,000 each to 10 universities, $10,000 each to seven, and summer research grants of $1,500 each to 16 other universities. The purpose of these grants is to encourage unrestricted fundamental research in chemistry.

Under the long-established program of postgraduate fellowships in scientific fields, the company is awarding 57 for the next academic year; including 23 in chemistry, 17 in chemical engineering, six in biochemistry, five in physics, four in mechanical engineering, and two in metallurgy. Du Pont will have no hand in the detailed administration of any of the grants, but will leave such decisions to the colleges and universities selected.

New Radiation Research Lab

Construction of a new radiation research laboratory at the research center of Diamond Alkali Co., Painesville, O., has begun, according to A. W. Meyer, director of exploratory research. Expected to be completed this month, the laboratory will investigate the possibility of harnessing gamma rays for such chemical applications as polymerization, oxidation, and chlorination.

Diamond believes it is one of the nation's first chemical companies to have a high-energy radiation source installed in its laboratories for industrial research. The Atomic Energy Commission has announced its encouragement of such activities which will help develop peacetime applications of atomic energy.

"One of the more important features of the laboratory will be a 1000-Curie radioactive cobalt irradiation source," Dr. Meyer revealed. "Radiation from this special cobalt source, fabricated for Diamond by AEC's Brookhaven National Laboratory, will be equivalent to the radiation from 2.2 pounds of radium which, presently, is almost one-half of the available world supply of refined radium."

Since 1953, the company has been one of three members of a nuclear power study team participating in the AEC's nuclear raactor development program. The two other companies are Foster-Wheeler Corp., New York, N. Y., and Pioneer Service & Engineering Co., Chicago, Ill.

A major task of the study team is to solve the problem of the ultimate use and disposal of highly radioactive fission products generated by a nuclear power reactor. Diamond's new laboratory is expected to contribute to the solution of this enigma.

C. C. Brumbaugh, director of atomic energy in alkali and electrolytic products research for Diamond, first proposed such a study team to the AEC. He was assisted in the original planning of the project by H. E. Everson and W. J. Lightfoot. Dr. Everson is now aide to Dr. Meyer, and will supervise research on radiation chemistry and special research in physical and inorganic chemistry.

Kel-F Dispersion Applications

With the development of dispersions, Kel-F fluorocarbons extend corrosion resistance to many metallic and non-metallic surfaces, according to Walter J. Merck, sales manager of M. W. Kellogg Co., Jersey City, N. J. Available as a low viscosity dispersion for spraying, and a high viscosity dispersion for spread, flow, and dip coatings, they reportedly result in a tough, continuous, adherent coating with all the important properties of the original plastic.

Current applications for fluorocarbon coatings include plating coils, expansion joints, valves, flowmeters, reactors, tanks and shipping containers, pipe lines, tire molds, ribbon blenders, distribution transformers, and miniaturized relays.

Kel-F films possessing high tensile and tear strengths and chemical resistance can be sealed by thermal impulse and hot jaw sealing. They are available as dispersion films of high molecular weight, and as extruded films 2-10 mils thick.

Glass cloth laminated with Kel-F plastic is produced in thicknesses of 20-30 mils. Applicable to flat and simple-curved metallic and ceramic surfaces, as well as plastic, wood, and cloth, the laminate can be used for covering and lining tanks and pipe.

Electronic Equipment Exhibit

Electronic equipment and materials having electrical and structural applications were displayed by Curtis-Wright Corp., Wood-Ridge, N. J., at the Hotel Biltmore, New York, N. Y., February 3-6. Among the items on exhibit were ultrasonic generators for quality control and inspection, electronic colorimeters, dielectric heaters, beta gages for continuous non-contact measurements of weight per unit area or thickness, and high-temperature foamed and laminated plastics.

Dow Enters Polyethylene Field

Polyethylene molding and extrusion materials for evaluation tests are being supplied to molders by Dow Chemical Co., Midland, Mich. Upon completion of a new production plant at Freeport, Tex., this summer full scale production is expected.

The plant will be of moderate size, according to Dow, so that attempts to develop new and more economical processes will not be hampered. No trade name has been established, and the material will be referred to as Dow polyethylene.

Hooker and Durez to Merge

Niagara Falls, N. Y., and Durez Plastics & Chemicals, Inc., North Tonawanda, N. Y., are conducting negotiations for a merger by the issuance of one share of Hooker for each share of Durez. In anticipation of the merger, Durez has declared a 10% stock dividend.

The North Tonawanda company is expected to be operated as a division of Hooker, and will retain the Durez name. Proximity of the main plants and offices should result in a broader base of operations, better research, and savings in production and administration. It is anticipated that the merger will increase Hooker's sales by approximately 50%.

The main advantage of the tie-in, according to Hooker, is in the plastic and resin industry. Durez is rated as one of the largest manufacturers of phenolic resins and compounding ingredients, and Hooker has recently entered the field with Hetron, a new polyester resin.

Eisenstein Acquires Bamberger

Norman Eisenstein, president of Ansbacher-Siegle Corp., Rosebank, N. Y., and Federal Color Laboratories, Cincinnati, O., has acquired the business conducted by A. Bamberger Corp., scrap and reprocessed plastics dealers, as well as of its affiliate, American Molding Powder & Chemical Corp., manufacturers of Ampacet thermoplastic molding compounds, both corporations being located in Brooklyn, N. Y.

Following are the new officers of both purchased corporations: Norman Eisenstein, president; Gerald F. Bamberger, executive vice president; Herbert H. Goldmark, vice president and sales manager; Matthew T. Staszak, vice president and plant manager; and Arthur T. Metzger, vice president and sales manager, vinyl department.

Plastics Fair Date Changed

Scheduled dates for the World Plastics Fair and Trade Exposition have been changed from April 6-10, 1955 to October 5-9, 1955. The Exposition site will be the National Guard Armory in Los Angeles, Calif., as previous announced.

Announcement of the rescheduling came after a series of meetings with SPI officials attending the recent Reinforced Plastics Conference. The new dates will not be in conflict with any other major meetings of the SPI or SPE, or any of their regional chapters.

Manufacturers who had contracted for exhibit space have all been contacted and all approve. Increased interest by Eastern firms in securing space, and the shortness of time previously available for readying exhibits were also responsible for the shift.

In Brief . . .

Ohio-Apex Division, Food Machinery and Chemical Corp., Nitro, W. Va., has opened a sales office at 2716 N. Broadway, Los Angeles, Calif. Glenn A. Farno, formerly of Westvaco chemical division, will head the office.

Applied Engineering Associates, Brooklyn, N. Y., has announced that it will custom cast multi-component resin mixes such as ethoxylenes, polysulfides, polyamides, foamed phenolics, and polyurethanes. The new service, according to the company, will be analogous to metal foundry shop operations for the preparation of castings.

Argus Chemical Corp., Brooklyn, N. Y., has announced the opening of a midwest office at 2063 E. Fourth St., Cleveland, O., under the direction of Richard N. Derr, who formerly served as a chemist with Firestone Plastics Co.

Rohm & Haas Co., Philadelphia, Pa., has announced a price reduction of four cents per pound for ethyl acrylate monomer, and one cent per pound for methyl acrylate monomer. New tankcar prices on a delivered basis are 38¾ cents per pound for ethyl acrylate, and 41¾ cents per pound for methyl acrylate.

B. F. Goodrich Rubber Co. of Canada, Ltd., has announced a change of corporate name to B. F. Goodrich Canada, Ltd. The new name provides a shorter title, and was designed to keep pace with the company's accelerated activities in fields other than rubber, such as chemicals and plastics.

Arthur B. Mullaly, president of Advance Solvents & Chemical Corp., New York, N. Y., has purchased control of Metalead Products Corp., Palo Alto, Calif. No merger between the respective organizations is contemplated at this time.

Rogers Corp., Rogers, Conn., manufacturers of plastics and fibrous materials, and the International Brotherhood of Paper Makers (A. F. L.) were to air their contract talks over closed-circuit television on February 15, as part of the program for the American Management Association's mid-winter personnel conference at the Palmer House in Chicago, Ill., on February 14-16.

Atlas Powder Co., Wilmington, Del., has moved its general offices from the downtown Delaware Trust Building, in which it has rented space for 34 years, to a new building of its own on a 45-acre tract of land about three miles from downtown Wilmington. The grounds also include an employee cafeteria-recreation building, swimming pool, tennis courts, and a baseball diamond.

Schenectady Resins, division of Schenectady Varnish Co., Inc., Schenectady, N. Y., has created a new sales region covering the Southeast. Tom Kee has been appointed technical representative for the area, with headquarters in Atlanta, Ga. The company's resin line includes phenolics, alkyds, terpenes, maleics, and foundry shell molds.

Monsanto Chemical Co.'s organic chemicals division, St. Louis, Mo., has announced the first commercial shipment of molten maleic anhydride in tank car lots. A chemical intermediate, maleic anhydride is used in protective coatings, reinforced plastics, and many other applications. Monsanto's tank car fleet includes equipment which will permit shipment in either 8,000- or 10,000-gallon quantities.

Dow Chemical Co., Midland, Mich., has announced a price reduction of approximately 10% on Styrofoam expanded polystyrene. Facilities at the Midland plant have been enlarged to meet increased demand for the material, and production at the new Styrofoam plant in Allyn's Point, Conn., is expected to begin soon.

Plastics in Legislation

A bill that would bar the manufacture, distribution, transportation, or sale of too realistic toy pistols was recently introduced in the New York State Legislature. The prohibition would extend only to toy pistols that were colored black, blue, silver, or aluminum. Many molded plastic guns were said to look particularly authentic.

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News from Abroad

German Plastics Conference, 1954

More than 1,600 German and over 100 foreign visitors, representing 14 different countries, attended the 1954 Plastics Conference held in Stuttgart on October 11-15, 1954. The conference was organized by the Working Association of the German Plastics Industry in collaboration with plastics and high polymer departments of German physical, chemical, and engineering societies, and the German Bureau of Standards.

Among the many papers read were some on economic as well as scientific and technological questions, since the conference also aimed at promoting cooperation between science and industry. The proceedings were opened by Dr. R. Rohm who delivered an address covering the burden of taxation on the plastics industry; unfair competition and the role of cartels; the progress made by Germany in the last two years; and the need for increased research and more scientifically trained personnel. Referring to preparations for the establishment of the German Plastics Institute in Darmstadt, which is to be connected with the Technical Institute of that city, he outlined the tasks the new organization will undertake, and revealed that work on documentation is scheduled to commence early in 1955, even before a building is up.

Another speaker, Dr. Karl Eichstadt, included some interesting production figures in his talk on the growing importance of plastics. He showed how world output of plastics had grown from 20,000 tons in 1900 (when celluloid, artificial horn, and vulcanized fiber were the main products) to 111,000 tons in 1930, 1,800,000 tons in 1952, and 2,100,000 tons in 1953. The comparative importance of the United States and Germany in world production of plastics since 1939 was given as follows:

	World Production, tons	United States		Germany	
		Production, tons	% of Total	Production, tons	% of Total
1939	300,000	100,000	33⅓	100,000	33⅓
1944	600,000	330,000	55	250,000	42
1950	1,500,000	1,030,000	68.5	100,000 (West)	6.7
				30,000 (East)	2.0
1951	1,800,000	1,160,000	64.5	170,000 (West)	9.5
				35,000 (East)	2.0
1952	1,800,000	1,110,000	62	190,000 (West)	10.5
				45,000 (East)	2.5
1953	2,100,000	1,320,000	63	240,000 (West)	11.5
				60,000 (East)	2.85

Isocyanates Output Expanded

Farbenfabriken Bayer, of Leverkusen, Germany, is planning a considerable increase in the production of isocyanates. An installation has been set up which has a monthly capacity of 2,000 tons, as compared with the previous monthly output of 400-500 tons, and this capacity is expected to be doubled in the near future.

New Acrylic Plastic

Rohm & Haas G.m.b.H., Darmstadt, Germany, has put on the market a new acrylic safety glass, Plexidur T, for which are claimed especially high impact strength and toughness, high weathering resistance, excellent dimensional stability, good light transmission, and good resistance to organic solvents. It is a tough and extensible material which flows after peak load is attained in stress-strain tests, and undergoes a permanent elongation of over 40%. Despite its toughness, the values for modulus of elasticity, and tensile and bending strength are said to be higher than those of any other thermoplastic material, and it can be used at service temperatures ranging from −60° to +60° C. Flexidur T is worked in the same way as Plexiglas, except that special precautions are needed in sawing, grinding and milling operations. Recommended molding temperature is 140° C.

Chemical properties are: satisfactory resistance to water (maximum absorption at 20° C. is about 20%), alkalies and acids (short-time exposures in concentrations up to 20%), paraffin hydrocarbons, alcohols, ethers, esters, and benzene and its homologs. Chlorinated hydrocarbons, ketones, phenols, and amines will cause limited swelling. With the aid of suitable cements, Plexidur T will adhere to itself and to other plastics, rubber, textiles, etc. The new plastic is recommended for use in shatter-proof protective devices; vehicles; goggles; and transparent protective housings.

French Polystyrene Production

There are now in France three factories, with total capacity of at least 12,000-13,000 tons annually, which produce all types of polystyrene. A large part of the output comes from the new factory at Wingles, near Lens, Pas-de-Calais, of the Monsanto-Boussois concern. Les Glaces de Boussois glass manufacturers, combined with Monsanto less than two years ago and, by October 1953, the Boussois glassworks had been redesigned and equipped with machinery imported from America. Production was on a commercial scale from the outset and now includes Lustrex 88, which is soon to be available in colors, as well as a special Lustrex for difficult moldings.

Polyester Foams in Australia

Cable Makers Australia Pty., Ltd., N. S. W., and S. A. Rubber Mills, Ltd., Adelaide, S. A., and Dandenong, Vic., Australia, have been appointed Australian manufacturers of elastic and rigid polyester foams for the furniture, upholstery, automotive, refrigeration, and thermal insulation industries, under license from Farbenfabriken Bayer AG., Leverkusen, Germany. Production is expected to commence in March, 1955.

German Plastics Production First Half of 1954

Production of plastics in West Germany continued to increase during the first half of 1954, though at a slower rate than in the second half of 1953, a trend noted throughout the chemical industry. Whereas production during all of 1953 has increased 25% over the preceding year, the first-half 1954 figure of 147,000 tons was only about 12% over that for the second half of 1953. The 1954 figure included 66,000 tons of polymerizates, 60,000 tons of condensation products, and 21,000 tons of cellulose derivatives.

Exports of plastics materials, not including unsupported film and sheet, came to 21,000 tons valued at 80,000,000 DM., an increase in value of about 15% over the second half of 1953. Compared with the total turnover of the plastics industry, the exports are considered only moderately satisfactory. They are well below the export quota of the chemical industry as a whole, and also below that of the other branches of the German industry. Of the exports, 68% went to European countries, 12% to South America, and 10% to Asia.

Foreign demand for unsupported German plastic sheet is increasing more rapidly than for artificial leather, latest figures indicate. While exports of the latter accounted for 11% of the total output of these materials in the first half of 1954, exports of the former came to 30%. The total output value of these products in the first half of 1954 came to 84,500,000 DM., which is an increase of about 25% over the total for the same period of 1953, with the increase for unsupported film put at 27% and that for artificial leather at not quite 20%.

NAMES in the NEWS

Carl T. Zinsmeister

Carl T. Zinsmeister, associated with United Engineering & Foundry Co., Pittsburgh, Pa., for 43 years, and now secretary of the firm, has been elected to serve on its board of directors. He is also assistant secretary and director of Stedman Foundry & Machine Co., Inc., a wholly-owned subsidiary of the company.

James O. King has been promoted to the position of special staff assistant in the sales department of Diamond Alkali Co., Cleveland, O.

Herbert Heesch has been appointed general sales supervisor of Hooker Electrochemical Co., Niagara Falls, N. Y. Formerly field sales supervisor, he will take on the added responsibility of coordinating sales and plant production, in addition to his present duties.

Arthur E. Gabriel has been appointed research project leader for Evans Research & Development Corp., New York, N. Y. Formerly of Armour Research Foundation, he will direct Evans' expanded activities in the resin, plastics, and adhesives fields.

Edward C. Nazzaro has been named sales representative for Sylvania Division, American Viscose Corp., Philadelphia, Pa. He will handle sales of sheet and roll cellophane in the St. Louis and Southern Illinois area, working from the Chicago district office.

Earl Erich has been added to the technical service staff of Tube Turns Plastics, Inc., Louisville, Ky. A specialist in solving industrial corrosion problems, **Mr. Erich** formerly served as research chemist for Atlas Mineral Products Co., and later organized and headed that company's thermoplastics division.

Gordon R. Porterfield has been named district representative of the New York area for Elmes Engineering Division of American Steel Foundries, Cincinnati, O.

Sol Sackel has resigned as director of advertising and merchandising for Bolta Products, division of General Tire & Rubber Co., Lawrence, Mass., to form his own advertising agency, Sackel Co., Inc., Boston, Mass. **David H. Simonds,** formerly product advertising manager, succeesd **Mr. Sackel.**

Donald I. Yarnall has been named general manager for the home office of Commercial Plastics & Supply Corp., New York, N. Y. He was formerly associated with Rohm & Haas Co. in sales of Plexiglas sheeting.

John H. Mathewson has been transferred from the Philadelphia district office to the fine chemicals division of Carbide & Carbon Chemicals Co., division of Union Carbide & Carbon Corp., New York, N. Y. His new duties will include market development of Flexol plasticizers for vinyl plastics, nitrocellulose lacquers, and associated materials.

Morgan Jones has been appointed plant manager for Acheson Dispersed Pigments Co., Philadelphia, Pa. Formerly vice president and general manager of Wilson Organic Chemicals, Inc., he will direct operations of Acheson's new installation at Orange, Tex.

Howard S. Bergen, Jr., technical service representative for Monsanto Chemical Co.'s organic chemicals division plasticizer department, has been transferred to the company's district sales office in Los Angeles, Calif.

M. W. Reynolds has been appointed general manager of Acheson Colloids Co., and **P. C. Buck** has been named head of engineering and production for the parent company, Acheson Industries, Inc. The two associated firms are in Port Huron, Mich.

Reginald Robinson has been named sales representative for the chemical sales division of Chas. Pfizer & Co., Inc., Brooklyn, N. Y. Assigned to the San Francisco area, he succeeds **Edward A. Poleselli,** who is being transferred to the headquarters of Pfizer International Subsidiaries, New York, N. Y.

A. J. McConvey has been named sales and service representative for the molded plastics section, Canadian General Electric Co., Toronto, Ont., Canada. His territory will include the Western Ontario area, with headquarters in Hamilton.

Daniel D. Lanning

Daniel D. Lanning has been appointed manager of sales development and technical service for the film department of E. I. du Pont de Nemours & Co., Wilmington, Del. **Whitney G. Hunter** has been named associate manager. **John P. Wilkins** succeeds **Mr. Lanning** as assistant manager in charge of sales development activities, and **Mac L. White** replaces **Dr. White** as supervisor of sales development. **Richard A. Sutherland** has become supervisor of a recently formed end-use research group.

Irving Skeist has established a chemical consulting service at 14 Edgar St., Summit, N. J. A registered patent agent, **Dr. Skeist** will specialize in research, development, and marketing of plastics and high polymers. He was formerly associated with Celanese Corp. of America, American Molding Powder & Chemical Corp., Newark Paraffine & Parchment Paper Co., and Gering Products, Inc.

Alander F. Hogland has been appointed general manager of Electronic Processes Corp., Los Altos, Calif., manufacturers of high-frequency and impulse-heat sealing equipment. He will supervise the company's field representatives throughout the country.

Peter W. Walkinshaw has been appointed plant superintendent for National Polychemicals, Inc., Wilmington, Mass. He was formerly associated with Carbide & Carbon Chemicals Co., Canadian Resins & Chemicals, Ltd., and Price Brothers & Co., Ltd.

Norman W. Oberle

John Hoenig

Norman W. Oberle has been appointed merchandising manager and **John Hoenig** has been named manager for the new die cushion and plastic press department of Baker Brothers, Inc., Toledo, O. **Mr. Oberle** formerly served as merchandising manager of the Plaskon division, Libby-Owens-Ford and of the Barrett division, Allied Chemical & Dye Corp. **Mr. Hoenig** has been with Baker Brothers since 1948 in the engineering and methods department.

J. Gordon Seiter

J. Gordon Seiter has been appointed manager of the newly formed high vacuum division, F. J. Stokes Machine Co., Inc., Philadelphia, Pa. He previously served as manager of vacuum metallizing sales. **G. Jewett Crites,** formerly sales manager for Stokes' vacuum furnaces, becomes manger of the vacuum processing division.

Jerome L. Frankel has been appointed manager of West Coast operations for Advance Solvents & Chemical Corp., New York, N. Y., and will supervise the new plant facilities at Palo Alto, Calif. He recently became affiliated with Metalead Products Corp., Palo Alto, Calif., and will direct their Leadleaf product sales and customer service activities as secretary-treasurer. **Eugene Dondero** succeeds **Mr. Frankel** as traffic manager for Advance Solvents with headquarters in Jersey City, N. J.

Three plastics product sales managers have betn appointed by B. F. Goodrich Chemical Co., Cleveland, O.: **W. D. Lahey,** manager of extrusion and molding materials; **E. B. Osborne,** calendering and coating materials; and **H. L. Wuerth,** wire and cable materials. All former sales representatives, they served the Chicago, Philadelphia, and New York City areas respectively.

Philip N. Felleman, a 25-year veteran of the rubber and plastics industries, has joined George Woloch Co., Inc., New York, N. Y., in an executive capacity.

Charles H. Frantz has been appointed executive director of new product development for Chicago Molded Products Corp., Chicago, Ill. He formerly served as works manager of Plastic Mfg. Co., and general manager of Kurz-Kasch, Inc.

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New Materials

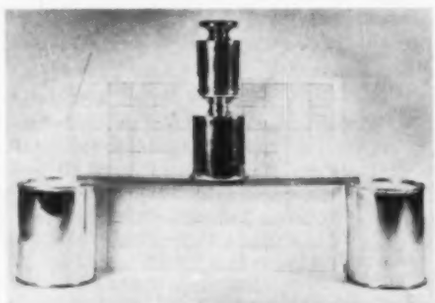
Bakelite Syntactic Foams

Lightweight plastic materials, called syntactic foams and having a wood-like cell structure of controlled density and strength, have been introduced by Bakelite Co., New York, N. Y. Designed for a variety of uses such as reinforcement of boat hulls, insulation for air-conditioners and refrigerators, and stiffening of hollow aircraft wings, the foam finds applications as a low-density filler in sandwich constructions, castings, and low-density aggregates.

Basic ingredients of the foam are listed as follows: a weighed amount of phenolic Microballoons, microscopic nitrogen-filled spheres developed by Bakelite in cooperation with Standard Oil Co. of Ohio; proper amounts of phenolic, polyester, or epoxy resins depending on the foam application and strength desired; and catalyst and accelerator, if polyester or epoxy resins are used.

Syntactic foam fillers can save up to 50% of the cost of reinforced structures without sacrificing strength or rigidity, according to Bakelite, and flexural strengths of 1,700-4,500 psi. can be developed, along with compressive strengths as high as 12,100 psi., and tensile strengths of 1,600-2,900 psi.

Uniform densities are obtained throughout the foamed structure. Syntactic foams ranging in density from 10-39 pounds per cubic foot are reportedly easy to prepare and can be drilled, sawed, or machined like wood.



Syntactic Foam Strip One Foot Long, One Inch Wide, and 0.12-Inch Thick Supporting 6½ Pounds without Significant Deflection.

Reinforced Phenolic Resin

A new glass-reinforced phenolic resin, said to combine low weight and high strength with resistance to temperatures of 500° F., has been introduced by the plastics division of Curtis-Wright Corp., Carlstadt, N. J. Physical and electrical properties are listed as follows:

Coefficient of thermal expansion, in./in./°F.	5-6 x 10^{-6}
Thermal conductivity, Btu./hr./ft./°F.	0.15
Specific heat, Btu./lb./°F.	0.23
Specific gravity	1.7-1.95
Density, lbs./cu.ft.	115
Effect of sunlight and weathering	Slight
Fungus resistance	Excellent
Operating temperature, °F., maximum long term	475
Single shear (vertical to laminations), specimen 1 x 4 x 0.14 inches, psi.	33,000
Block compress., 1-in. cube, vert. laminate, psi.	50,000
Compression strength edgewise, psi.	40,000
Conditioned*	30,000
Flexural strength, psi.	65,000
Conditioned*	50,000
Young's modulus in flex x 10^{-6}	3.5
Conditioned*	3.25
Water absorption, ASTM, 24 hrs., %	0.45
Volume resistivity, megohms	1.25 x 10^{12}
Surface resistivity, megohms	6.82 x 10^{12}
Power factor at 1 megacycle	0.0098
Conditioned*	0.0055
Dielectric constant at 1 megacycle	4.00
Conditioned*	3.98

*Conditioned at 500 °F. for ½-hour.

The new material is being evaluated in the aircraft industry where it is being used for missile radomes, antenna housings, ducting for hot gases, and jet engine parts. It is expected to find broad applications wherever the advantages of reinforced plastics need to be coupled with high strength and temperature requirements.

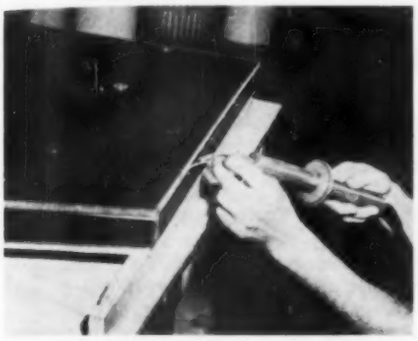
Calendered Rigid PVC Sheets

A new calendered rigid polyvinyl chloride sheet, adapted to the production of corrosion-resistant tanks, ducts, and similar structures by welding, has been introduced by Bakelite Co., New York, N. Y. Reportedly possessing excellent resistance to chemicals and moisture, a high heat distortion point of 160 F., and high impact, tensile, flexural, and welding strengths, the new sheet meets SPI specifications for Type I rigid sheet for structural purposes.

A recent application involved the construction of a self-supporting electroplating tank by machining and welding laminated sheets of the new material. Continuous sheets were calendered 51½ inches wide and 0.015-inch thick, and laminated into sheets 120- by 51½- by ⅜-inches by Laminations, Inc., Scranton, Pa. The tank

was fabricated by American Agile Corp., Maple Heights, O. The sheets were sawed, machined for plug ends and nipple outlets, and welded.

Bakelite produces both natural unpigmented and opaque sheets ranging from 0.010-0.015 inch in thickness in continuous rolls up to 51½ inches wide. Planished sheets measuring 20 by 50 inches are available up to 1¾ inches thick. Larger planished sheets can be obtained through custom laminators.



Side sheet of rigid PVC electroplating tank being welding to end and bottom strips.

Heat-Stable Phthalocyanine Blue

A blue-green pigment for vinyl compounds, reportedly resistant to color change both in masstones and tints, has been introduced by Claremont Pigment Dispersion Corp., Brooklyn, N. Y. Designated Heat-Stable Phthalocyanine Blue, the pigment retains its original color when subjected to vinyl processing temperatures of 350° F. for periods up to 60 minutes, and 425° F. for 10 minutes.

Color-calibrated to insure uniformity between runs, the new material is available both in paste form for films, sheeting, and coated fabrics, and as a dry concentrate for use in extrusion compounds.

Acme Markets Fluorine Polymer

A new and reportedly improved fluorine polymer characterized by great chemical inertness, wide range of working temperature, and zero water absorption, has been introduced by Acme Resin Corp., Forest Park, Ill. Named Polyfluoron, the new polymer has been in pilot plant production for over two years, during which period its quality has been evaluated in production molding and extruding.

Physical properties as determined by ASTM test methods, are listed as follows:

Specific gravity	2.12
Tensile strength at 77° F., psi.	5890
Elongation, %	25-87
Dielectric strength, short time (1/16-inch), volts/mil	600
Dielectric constant, 1 megacycle	2.37
Impact strength, Izod, ft. lbs./in. notch	1.52
Water absorption, %	0.00

Production is divided into three grades according to molecular weight as determined by the so-called NST (no-strength temperature) method. Grades HT, MT, and LT, have NST ranges of 285-315, 255-285, and 230-255, respectively. Polyfluoron is available in crystal granules for extrusion and injection molding; in a low-density powder for compression molding; in high-density fused pellets, and in a 40%-solids dispersion.

Characteristically, fluorine polymers degrade to a lower molecular weight after long exposure to very high temperatures. Polyfluoron, however, is said to have excellent flow properties, and it is usually not necessary to subject it to temperatures high enough to cause degradation. Typical injection molding conditions for the HT grade are reported to require a barrel temperature of 540° F.; internal temperature, 550° F.; nozzle temperature, 560° F.; mold temperature, 280° F.; injection pressure, 30,000 psi.; and a total cycle of 38 seconds. These conditions were used on a single-cavity mold with approximately three ounces of material per shot using a Lester machine.

Properties of Polyfluoron moldings may be changed by altering the conditions under which they are cooled. According to Acme, the polymer has a tendency to crystallize if cooled slowly, particularly at temperatures around 400° F. Rapid cooling impedes this formation of crystals which cause the product to become cloudy, stiff, and brittle.

According to D & R Pilot Plants, Inc., Hazardville, Conn., distributors and servicers of Polyfluoron in the East, dispersions provide a simple means of casting films and coating objects with polychlorotrifluoroethylene. Being non-adherent to most smooth materials, the dispersions require a special primer. Available items include the 40%-solids dispersion, a 10-phr. blue pigment dispersion, Dispersant A, Thinner 31, and Primer 140.

Campco Styrene-Rubber Sheet

A modified styrene-rubber blended sheet, said to have improved impact strength, fine texture, and freedom from strains, has been introduced by Campco Division, Chicago Molded Products Corp., Chicago, Ill. Designated Campco S-540, the new sheet reportedly provides twice the impact strength of Campco's S-300 at no increase in price.

Properties, as determined by ASTM test methods on 80-mil samples, are as follows:

Specific gravity	1.04-1.07
Water absorption, 25 hrs., %	0.10
Heat distortion, °F. at 264 psi.	170-175
Tensile strength, psi.	4,000-4,500
Elongation in tension, %	28-30
Modulus in tension, psi. x 10^3	350-375
Flexural strength, psi.	No failure
Impact strength, 60-mil notched sample, ft.lbs./in. of notch	2.5-4.5
Coefficient of expansion, in./in./°F. x 10^{-5}	6-8
Flammability, in./min.	1.5-2

Campco S-540 is available in thin gages from 10-30 mils thick in widths to 26 inches, and in heavier gages of 40-187 mils with widths ranging to 40 inches. The thin sheets are supplied with mat or polished surfaces, the thicker material in mat, polished, or high-gloss (GM) finish, the latter having a luster comparable to porcelain enamel.

The thin material is recommended by the company for printed jobs requiring close register, displays, packaging, and toys, whereas the heavier sheets find application in equipment housings, refrigerator parts, racks, and trays.

Didecyl Phthalate Plasticizer

A new didecyl phthalate plasticizer for use in applications where low volatility and improved aging are prime considerations, has been introduced by Barrett Division, Allied Chemical & Dye Corp., New York, N. Y. Called "Elastex" 90-P Plasticizer, the practically colorless ester is said to be a general-purpose primary plasticizer which imparts good physical properties, especially resistance to thermal degradation.

Barrett also recommends its use with PVC plastisols, where it reportedly confers excellent viscosity stability. Typical properties are listed as follows:

Odor	Mild alcoholic
Color, Hazen	25
Molecular weight (theoretical)	446.65
Specific gravity at 20/20 °C.	0.967
Pour point, °C.	—30
Viscosity, cps.: At 5 °C.	376
At 25 °C.	78
At 50 °C.	27
Refractive index	1.484
Flash point, open cup, °F.	430
Fire point, open cup, °F.	507
Acidity (as phthalic acid), wt. %, max.	0.002
Saponification number	250.7
Weight, lbs. per gal., at 68 °F.	8.1

Boltaron 8100 Series

A low-cost formable plastic sheet material has been introduced by Bolta Products Division, General Tire & Rubber Co., Lawrence, Mass. Called Boltaron 8100, the new material reportedly has an impact strength intermediate between that of modified styrene extruded sheets and styrene copolymer laminated sheets.

Available in a variety of colors and finishes, the plastic sheet is designed for such applications as packaging units, displays, bench assembly trays, refrigerator parts, and business machine housings. The following is a list of physical properties for the natural color compound.

Specific gravity	1.04
Tensile strength, psi.	2,200
Elongation, %	30-40
Izod impact at 70° F., ft.lbs./in. of notch	6
Shore "D" hardness	74
Heat distortion, °F.	180
Forming, ring and plug	Good
Vacuum	Good
Shrinkage, %	3-5

Saran Monofilament—Q-909

A new formulation of saran resin for monofilaments has been introduced by Dow Chemical Co., Midland, Mich. Designated Q-909, the material is said to have four times the outdoor light stability of the other formulations, 30-40 times longer life based on 3% shrink, better static reduction, improved color range, and lower exudation and odor levels.

Q-909 is already being used by weavers of fabrics for lawn furniture, automobile seat covers, upholstery, and window screening. It is expected to enter new markets such as venetian blind tapes and awnings. Physical properties are comparable to present formulas, and mechanical properties are listed as follows:

Tensile strength, psi.	40,000
Knot strength, psi.	20,000
Elongation, %	20-25
Light stability, hours to darken	1,000
Fadeometer stability	Excellent
Dimensional stability, % shrinkage in boiling water in 10 min.	10-12
Hours to reach 3% shrink at 95° C.	340
Static build-up and retention	Reduced
Plasticizer exudation	Good
Retention of flexibility on aging	Excellent
Odor	Good
Extrudability	Good
Extrusion characteristics are as follows:	
Estimated efficiency,	92-97
Dieface build-up, hours	3-8
Chafing	Excellent
Color streaking	Excellent
Heel release	Good
Slubs/min., natural	Excellent
White	Excellent
Blue	Fair
Carbon formation	Very good
Orientation ratio	3.8:4.1
Extrusion rate	Excellent

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Hydrated Silica Filler

A new hydrated silica of extremely fine particle size, intended for use as a reinforcing filler for plastics and rubber stocks, has been introduced by Columbia-Southern Chemical Corp., a subsidiary of Pittsburgh Plate Glass Co., Pittsburgh, Pa. Called Hi-Sil 233, the filler is said to act as an anti-caking, processing, and grinding agent because of its high absorbency.

Hi-Sil 233 is marketed in 50-pound multi-wall paper bags. Unitized loading is not presently available. Typical chemical and physical properties are listed as follows:

Bulk density, lbs./cu.ft.	10
Color	White
Specific gravity	1.95
Average particle size, microns	0.022
Refractive index	1.46
Oil absorption, gm. oil/100 gm.	170
Surface area, sq.m./gm.	150
pH in 5% water suspension	7.3
Loss at 105° C., %	5
Total loss on ignition at 1,200° C., %	10
Composition:	
SiO_2, %	87
CaO, %	0.5
Fe_2O_3, %	0.2
Al_2O_3, %	0.6
NaCl, %	1.0

Ampcoflex Vinyl Cements

Three ready-to-use cements for the permanent joining of unplasticized PVC and styrene-rubber blend sheets, plates, fabricated structures, and pipe have been introduced by Atlas Mineral Products Co., Mertztown, Pa. Based on balanced solvent systems, they reportedly permit rapid joining of sections without the danger of poor adhesion caused by fast-drying solvents.

Ampcoflex Adhesive is a low-viscosity, unfilled and unplasticized solution of vinyl resin designed for joining closely mated surfaces, such as lap joints of sheet material, assemblies of heavy sections from thin plates, and threaded pipe fittings. Bond strength approaching that of the base material is claimed.

Ampcoflex Joint Sealer, a slightly-filled fast-drying cement, is intended for bell-and-spigot or slip-fit plastic pipe and fittings. High pressure bursting tests on bonded assemblies have indicated failure within the pipe itself rather than at the juncture.

Ampcoflex Putty is a heavy, filled, putty-

like cement for filling voids and smoothing sharp corners, angles, and irregular surfaces. Having a solids content of over 60%, it sets rapidly without cracking, according to Atlas, and forms a hard, chemically resistant surface.

The new materials are available in pint, quart, gallon, and five-gallon metal containers. Adhesive and joint sealer should be allowed to set for 10 minutes before joining to the female member. Since the cements contain volatile, toxic solvents, all containers should be kept tightly sealed and stored in a cool place.

Phthalate Plasticizer Blends

As part of a new policy, Pittsburgh Coke & Chemical Co., Pittsburgh, Pa., is making available to customers blends of their standard plasticizers. The first such blend to be marketed in tank truck or car quantities consists of a 2:1 combination of their isoocytyl decyl and decyl butyl phthalates, and is said to offer several advantages over DOP in a wide range of applications. The following chart compares the properties of DOP and the blend, in formulations based on 100 parts resin, 54 parts plasticizer, and stabilizer:

	DOP	Blend
Modulus at 100% elongation	1600	1670
Shore hardness, 10 sec.	78	80
Clash-Berg low temp. flexing, T_f, °C.	—26	—25
A. C. volatility, 24 hrs./90° C., %	5	5
Oil extraction, 7 days/25° C., %	1.4	1.5
Gasoline extraction, 1 hr./25° C., %	14.3	12
Soapy water, 1% conc., 24 hrs./60° C., %	0.9	1.2
Silicilic acid test, 24 hrs./60° C., %	4.5	4.4
Tensile strength, psi.	3100	3050
Ultimate elongation, %	370	380

Other plasticizer blends are available to customer specifications as custom blends.

Bakelite Rigid Polyethylene

A new type polyethylene, said to have greater rigidity and temperature resistance, is being produced in pilot plant quantities by Bakelite Co., New York, N. Y., at its plant in South Charleston, W. Va. Reportedly manufactured under conditions that approximate atmospheric pressure and temperature, the resin is expected to increase the range of applications for the company's polyethylene materials.

While complete data is not yet available, softening points up to 240° F. are reported; 20-30° higher than that for conventional polyethylene. The greater rigidity offers advantages in the molding and vacuum forming of large products and toys.

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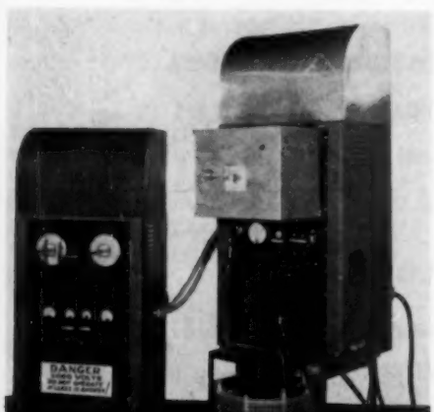
New Equipment

High Frequency Research Unit

A new, high frequency unit for both induction and dielectric heating has been introduced by Radio Frequency Co., Medfield, Mass. Consisting of a 5KW induction heater connected to a 5KW dielectric head and a powerstat for controlling the output, the unit reportedly makes available for research practically every phase of high frequency heating plus a number of useful voltages.

Induction heating applications include sealing polyethylene, bonding Teflon, glueing, brazing, and annealing of metals. Among the dielectric uses of the unit are polymerization and sealing of plastics; vulcanization; sterilization of liquids and solids; and gas ionization in spectroscopy. The unit can be used initially in the laboratory for research, then transferred directly to production work.

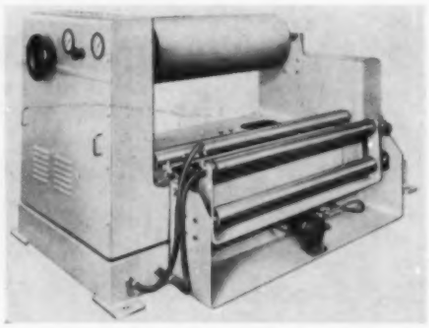
The dielectric unit can be run continuously at a frequency of 85 megacycles. The induction unit has a 10KW output tube, both outputs being variable from 0-5 kilowatts. By simple switching in the wiring, a wide series of voltage ranges can be made available; 0-100,000 volts DC, 0-7,000 volts AC, and 0-125,000 volts RF.



High Frequency Research Unit Consisting of 5KW Induction Heater, 5KW Dielectric Head, and Small Powerstat for Controlling Output

Tension-Control Backstands

New backstands, which reportedly control both tension and edge position of a moving web as it is fed to a rewinder, slitter, or converting machine, have been introduced by Askania Regulator Co., Chicago, Ill. Fully hydraulic, the tension control systems use an incompressible fluid to transmit signals, and are said to cut response time to one-quarter that of an otherwise comparable pneumatic/hydraulic control system.



Askania Backstand for Controling Tension and Edge Position

Tension may be maintained at any selected value up to four pounds per inch within 5% at any steady web speed. Edge position is maintained within 15 mils with a runout of approximately three inches from center position.

The backstands operate at speeds up to 1,200 feet per minute, and will handle web widths from 12-54 inches. Rolls up to 2,000 pounds with 48-inch diameters can be accommodated. Control is maintained down to a three-inch core.

Three models are available, designed to handle rolls 36, 48, and 54 inches in width. The smallest unit is 51½ inches deep, 87½ inches wide, and 42 inches high; the other units being proportionately wider. The unwind stands and control systems are combined in an integral package requiring only electrical and air connections for operation; however, the larger units may require water to cool the brake.

The control panel may be installed remotely for the operator's convenience. The tension gage may be calibrated to read in pounds per inch if only one web width is to be handled, or in total pounds of tension force.

Vertical Two-Stage Grinder

A new high speed grinder, said to equal the output of four equivalent conventional 10-hp grinders, has been introduced by Injection Molders Supply Co., Cleveland, O. Called the IMS Model M400 2-Stage Grinder, it incorporates two cutting chambers mounted vertically, one above the other, to conserve labor, power, and space.

M400 has an 11- by 14-inch throat opening and is powered by a 10-hp motor.

IMS Model M400 All-Steel Grinder

The top screen is standard 1¼ inches, and the bottom screen 5/16-inch; however, other screen sizes can be specified. Both screen assemblies can be removed for cleaning. The hopper is hinged and may be tilted back.

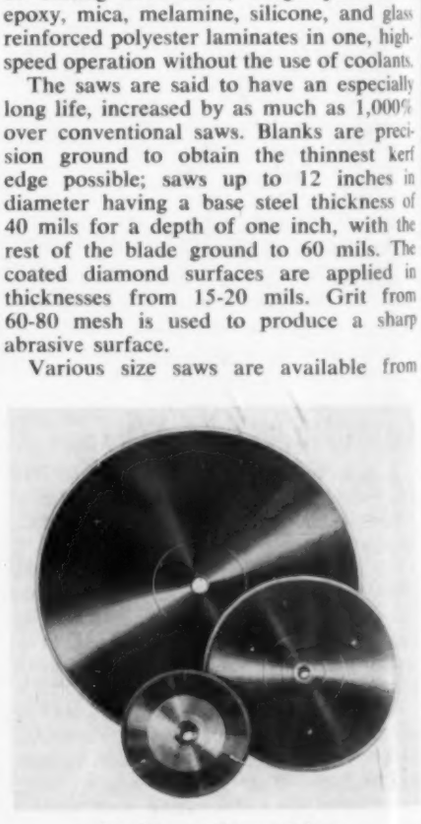
Blades are segmented and can be removed by sections, thus lessening the cost of replacement. The machine has a double drive to avoid shock and bearing wear. Provision is made for a full-size material drum under the lower cutting chamber, but the unit is also available with a low base for floor level feeding. Other dimensions include an overall height of 96 inches, and a 36- by 40-inch base.

Diamond-Steel Bonded Saws

Diamond saws incorporating a new direct diamond-to-steel bonding process have been instroduced by Dia-Chrome Co., Glendale, Calif. Designated Dia-Chrome Diamond Saws, they are reportedly capable of cutting such hard, tough plastics as epoxy, mica, melamine, silicone, and glass reinforced polyester laminates in one, high-speed operation without the use of coolants.

The saws are said to have an especially long life, increased by as much as 1,000% over conventional saws. Blanks are precision ground to obtain the thinnest kerf edge possible; saws up to 12 inches in diameter having a base steel thickness of 40 mils for a depth of one inch, with the rest of the blade ground to 60 mils. The coated diamond surfaces are applied in thicknesses from 15-20 mils. Grit from 60-80 mesh is used to produce a sharp abrasive surface.

Various size saws are available from



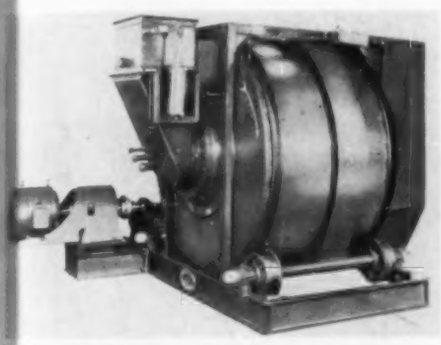
Dia-Chrome Diamond Saws

6-18 inches in diameter, with rim thicknesses from 80-210 mils and kerf cutting edges of 72-110 mils. Additionally, Dia-Chrome coats any size, shape, or dimension of saw, wheel, planer, or router with their bonded diamond surface.

Sealed-Unit Rotary Blender

A new rotary blender, featuring a sealed mixing unit of dust-tight construction, has been introduced by Davidson-Kennedy Co., Atlanta, Ga. Called D-K Rotary Blender, Model B-50, the unit is said to have wheel bearings, wide clean-out doors, and alloy steel plate mixer flights arranged to give complete blending in minimum time.

The new mixer is available in 37-, 59-, and 69-cubic foot mixing capacities, based on ½ of the total volume.



Davidson-Kennedy Rotary Blender

Model 16ES-400 Injection Molder

A new, high speed machine has been added to the line of preplasticizing type injection molding machines manufactured by Watson-Stillman Co., division of H. K. Porter Co., Inc., Roselle, N. J. Called Model 16ES-400 Injection Molding Machine, this fully hydraulic press features a polystyrene rated 64-ounce shot capacity and a 425-ton clamping force.

Other features include a radial piston-type motor-driven pumping unit, semi-automatic control, rapid operating speeds, adjustable injection speed, independent control of injection and clamping pressures, internally heated plasticizing cylinder with four-zone temperature control, and a plasticizing rate of 200 pounds of polystyrene per hour.

Machine specifications are listed as follows:

Stroke, in.	24
Daylight opening, in.	40
Horsepower	55
Die space, in.	25 x 45
Hopper capacity, lbs.	200
Hopper feed capacity, cu.in.	60
Maximum cycles per hour	300
Speeds:	
Die closing (forward) in./min.	600
Die closing (return) in./min.	650
Injection (return) in./ min.	265
Maximum injection speed at 21,000 lbs./sq.in. inj. pressure, in./min.	130
Injection plunger diameter, in.	3¼
Maximum die sizes, in.	20 x 36 x 21 x 33
Oil reservoir capacity, gal.	190
Floor space required, ft.	16½ x 5⅓
Overall height, ft.	8½
Shipping weight, lbs.	30,000

Hi-Speed Abrasive Disc Grinder

A grinder operating at a perimeter speed of more than 18,000 feet per minute, and utilizing two abrasive-coated cloth discs, has been introduced by New Era Engineering Co., Chicago, Ill. Designated Neeco-2-Twenty, the grinder is powered to handle the heaviest material loads without reducing disc speed.

The machine is reportedly flexible, in that both rapid material removal and fine finish can be accomplished by using coarse grit abrasive on one disc and fine grit on the other. The unit is expected to be of interest to manufacturers and processors of plastics, hard rubber, wood, and other materials.

The double-disc machine is powered with a 10-hp, 3,600-rpm. motor with a 220/440-volt, ⅔-phase, 60-cycle direct drive. Other specifications include:

Disc diameter, in	20
Work tables, in.	12 x 36
Base plate, in.	36 x 42
Maximum dimensions, in.	52¼ x 42
Height, in.	49
Weight, lbs.	2000

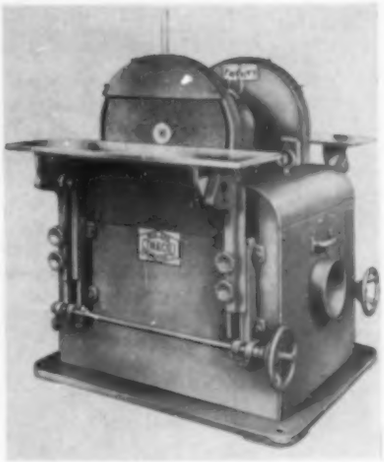
A dust collector is available as optional equipment. Housed within the machine, it consists of multiple-filter cloth bags over a steel framework, and a turbo-axial blower mounted on the shaft of a 1½-hp motor.

PHI 70 Ton H Type Press

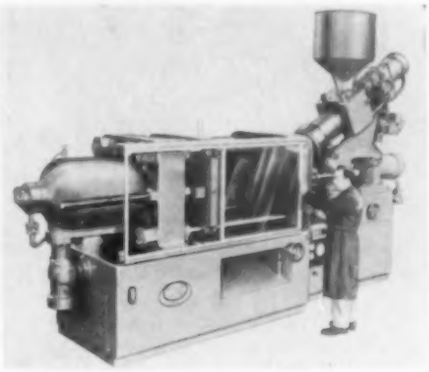
A new automatic press with 18- by 18-inch electrically-heated, water-cooled platens has been introduced by Pasadena Hydraulics, Inc., Pasadena, Calif. Named P.H.I. 70 Ton H Type Automatic, the presses are available in four models: Model HA 250, two-platen, single-opening; Model HA 350, three-platen, double-opening; Model HA 450, four-platen, triple-opening; and Model HAL 450, four-platen, one hot opening, one cold opening.

The platens, which have cast-in cooling coils and 230-volt, 4,000-watt Calrods, are controlled to 600° F. by Fenwal Thermoswitches and Allen-Bradley relays. An electric cycle timer opens the press at preselected intervals and resets for the next cycle. The eight-inch opening has a removable adapter for obtaining 12-inch daylight with a single opening.

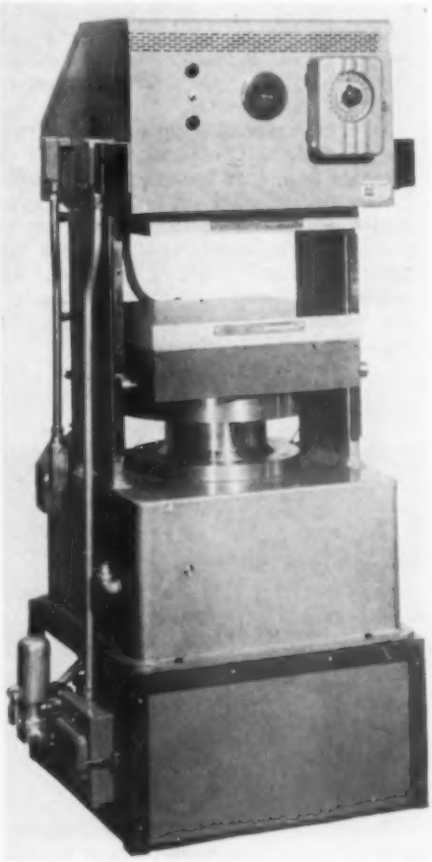
Push-buttons control the high and low pressure pumps which operate the 6¾-inch diameter hydraulic ram. Stroke is eight inches with adjustable down stroke trip. The 2,600-pound machine is 72 inches high and measures 26- by 26 inches at the base. The presses can be modified to suit customers requirements.



Neeco-2-Twenty Hi-Speed Abrasive Disc Grinder



Watson-Stillman Injection Molding Machine



Pasadena 70 Ton H Type Automatic Press

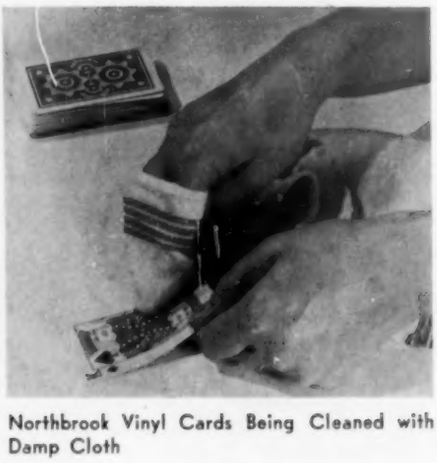
New Products

Plastic-Rubber Track for Combination Storm-Screen Windows

Plastic Track for Storm Sash

A self-lubricating plastic track for combination storm-screen windows, has been developed by Robert S. Crane Associates, Columbus, O. Made from Kralastic, Naugatuck's tough, corrosion-resistant plastic-rubber blend, the tracks are smooth-surfaced and triple-grooved for fitting into the windows' metal frame.

Window units slide up and down without sticking or binding, according to Weather Seal, Inc., Barbertown, O., manufacturer of the windows, and the tracks are flexible enough to compensate for any expansion of the metal. Track sections fastened to the upper half of the frame, and snapped in place in the lower half, enable the housewife to remove the lower track for cleaning of the storm sash.



Northbrook Vinyl Cards Being Cleaned with Damp Cloth

Vinyl Playing Cards

The first playing cards of rigid vinyl plastic have been introduced by Northbrook Plastic Card Co., Northbrook, Ill. Said to outwear up to 100 decks of ordinary cards, they are made from Goodrich Chemical's Geon vinyl in the form of sheeting supplied by Nixon Nitration Works.

Resistant to the effects of alcohol and other fluids, the cards can be cleaned with a damp cloth, drying each card separately. Soap can be used to get out stubborn stains. The cards are designated Windsor Medallion, and are available in blue and red colors.

Rubatex Vinyl Foam

A new sponge-like vinyl foam cushioning material has been introduced by Rubatex Division, Great American Industries, Inc., Bedford, Va. Trademarked Gai-Foam and manufactured under the Elastomer process, it consists of vinyl plastisols which have been cured by radio high-frequency equipment.

Checking Extruded Sheets of Rubatex Gai-Foam After Cure

Advantages claimed over regular latex foam cushioning include uniform cell structure, heat sealability, compatibility with plastic covers, and resistance to aging, tearing, light, abrasion, and moisture. A tensile strength of 15-30 psi., and a compression deflection of 10-20 pounds per 50 square inches are reported. In addition, Gai-Foam is said to possess excellent flame resistance, and will not stain or oxidize.

Gai-Foam is produced in flat utility stocks and in a variety of colors. Slab utility, crowned utility, and molded cushions are scheduled for production in the near future. The product is available in continuous sheets up to 10 feet in length, in widths to 24 inches and thicknesses to two inches.

Commode with Vinyl-Surfaced Extension Table

Commode Table Combination

A space-saving commode which can be transformed into a sideboard and no-leaf extension dining table, has been introduced by Saginaw Furniture Shops, Inc., Chicago, Ill. Trademarked Expand-O-Matic Commode, it consists of a commode with drawers for storing table linen, retractable legs, and table top of Bakelite rigid vinyl sheet.

Designed for small apartments, a light and steady pull extends the retracted legs and table top to any desired length. Fully extended the table provides 63- by 40- inches of dining surface, or enough to seat eight people. The vinyl top, which rolls out in similar fashion to a window shade, is laminated over fibrous glass and decorative fabrics, and glued to the supporting wood under-structure.

When not extended, the top occupies a space paralleling the front, back, and bottom sides of the commode. A smaller commode with cabinet doors and shelves instead of drawers is also available.

Plastic Battery Service Unit

A battery servicer case of high impact butyrate and an internal distilled water compartment of flexible vinyl for distribution by Heyer Industries, Inc., Belleville, N. J.

Acid, oil, and gasoline resistant, as well as shockproof, the case also has a smooth finish which conveys an impression of cleanliness and efficiency. The Servicer Unit is equipped with a battery-regulator voltage tester, a self-leveling battery filler with flexible spout, a prod with a 36-inch lead, and a two quart-capacity distilled water container.

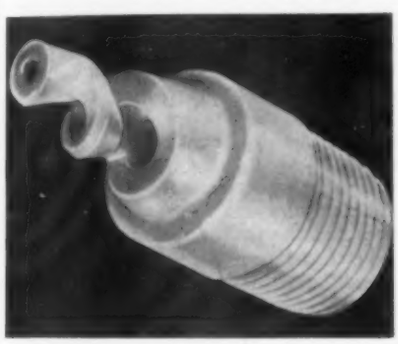
Plastic Battery Servicer Case and Distilled Water Container

The test voltage regulator includes an O.C.V. Battery Tester, a 6 and 12 v. Regulator Tester, and a Battery Load Tester. The Test Meter is optional equipment and, without it, added space is available for tools or a hand meter.

Fluorocarbon Spray Nozzles

A new line of spray nozzles called the "TF" series has been introduced by Bete Fog Nozzle, Inc., Greenfield, Mass. Made from a solid bar of DuPont's Teflon, the nozzles are said to possess the same properties as those of the bar; namely, resistance to erosion, chemicals, and continuous operating temperatures of 500° F.

The spiral design eliminates internal parts and strainers, thus reportedly eliminating the possibility of clogging. The new nozzles are available in 10 models with 50° and 120° spray angles, and hollow cone spray patterns; five orfice sizes from 5/16-7/16 inch; and five flow rates from 5-50 gallons per minute. They are threaded with 3/8- or 1/2-inch male pipe threads.



Spray Nozzle of Machined Teflon

Vinyl-Base Pigments—A New Art Medium

Vinyl-Based Artist Pigments

Vinyl-based pigments, similar in appearance to oils, have been introduced as a new art medium by Vinyl Art Supply Corp., Argyle, N. Y. Called Vasco, the new material stems from a Geon vinyl base and was developed as a joint enterprise by Albert Jacquez, of the Woodstock, N. Y., art colony, and scientists of the B. F. Goodrich Chemical Co.

Vasco is applied with a conventional brush or palette knife onto vinyl-coated canvas, which provides minimum penetration and maximum adhesion of the pigments. Heat is applied for two to five minutes to set or fuse the paint, depending on the thickness. A heat lamp, a kitchen oven at 350° F., or an electric iron applied to the back of the canvas, will complete the bond.

Specially mixed colors reportedly will not set, even though exposed for weeks. Finished canvasses are impervious to water and will withstand double folds or rolling without cracking or separating. Adaptable to nearly every type of art work, Vasco is packaged in conventional tubes with special thinner.

Translucent Fiberglass-Reinforced Plastic Building Panels

A new fibrous glass-reinforced plastic building panel, said to combine the advantages of translucence and coolness, has been introduced by Alsynite Co. of America, San Diego, Calif. Trademarked "Steplap," the panels contain Filtron 25, a heat-blocking ingredient which reportedly controls light and heat ray penetration.

Designed so that there is a one-inch wide flat surface lying flush with the supporting framework at each lap on the panel, "Steplap" provides simple installation and increased load strength. Intended usages include overhead coverings for patios, sun porches, and carports.

The panels are available in standard widths of 31½ and 41½ inches, and a standard length of 10⅓ feet. Each step of the panel measures five inches, including the flush fastening surface. "Steplap" comes in five new Catalina colors: white, yellow, coral, blue, and green.

"Steplap" Reinforced Plastic Building Panel

News of Societies cont'd. from page 101

SPI Reinforced Plastics Division Meeting a Success

Pach Bros., N.Y.
Joseph L. Rodgers

Edward A. Jonasch

John S. Berkson

Samuel S. Oleesky

The tenth annual Technical and Management Conference of the Reinforced Plastics Division, Society of the Plastics Industry, Inc., was held at the Hotel Statler, Los Angeles, Calif., on February 8-10. Some 1,000 persons representing 337 companies attended the meeting, the first time that a national division of SPI has met on the West Coast. Of the approximately 150 companies in the reinforced plastics industry, half are located in the western states. There are more than 50 firms in California alone, with a total sales volume of more than $100 million yearly.

Following the format of previous Conferences, the meeting consisted of morning technical sessions; daily luncheon meetings; afternoon contact periods on February 8 and 9; an open forum on the afternoon of February 10, followed by a reception and the Division's annual banquet; and an exhibit of reinforced plastic parts.

The technical sessions were devoted to the general subjects of aircraft applications; military uses; reinforced plastic tools; construction and corrosion-resisting applications; electrical uses; tools for molding reinforced plastics; and transportation, housings, and materials handling. The more than 40 papers presented during these sessions, and their discussion will be available in a Proceedings of the Conference, to be published by the Society.

Officers of the Division for the coming year are as follows: general chairman, Samuel S. Oleesky, Micronics, Inc.; eastern chairman, Joseph L. Rodgers, Bakelite Co.; midwestern chairman, Edward Jonasch, Jonasch Plastics, Inc.; western chairman, John S. Berkson, Alsynite Co. of America; and secretary, Charles L. Condit, of the SPI. All of the officers were re-elected, except for Mr. Jonasch who replaced A. J. Wiltshire, Apex Electrical Mfg. Co., as midwestern chairman.

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Book Reviews

"Adhesion and Adhesives — Fundamentals and Practice." Edited by F. Clark, John E. Rutzler, and Robert Savage. John Wiley & Sons, Inc., 440 Fourth Ave., New York, N. Y. Cloth, 8½ by 11¼ inches, 229 pages. Price, $9.75.

The volume consists of edited versions of papers read at a symposium sponsored by Case Institute of Technology in Cleveland, O., April 24-25, 1952, and the contributions and discussions from the Society of Chemical Industry's conference, held in London, England, April 22-24, 1952.

The purpose of both conferences was to bridge the gap between new product research and the development of better adhesives, the emphasis being on theory. The 43 papers cover such topics as joint strength, solid-solid interfaces, fluids, and molecular and inter-molecular forces. Fields covered include plastics, rubber, wood, paper, glass, roads, films, aircraft, metals, and textiles. The book is illustrated and contains many tables, graphs, and equations.

"Materials for Product Development—1954." Clapp & Poliak, Inc., 341 Madison Ave., New York, N. Y. Cloth, 6 by 9 inches, 159 pages. Price, $7.50.

The volume contains the texts of thirteen papers delivered before the Basic Materials Conference, held in conjunction with the Second Basic Materials Exposition, Chicago, May, 1954. The papers deal with six basic problems: materials of the future; new metal forming processes; non-metallic materials, including plastics, carbon-graphite, ceramics and glass; joining, with emphasis on adhesives and adhesive bonding of metals and plastic; corrosion protection; and materials management, describing the methods of setting up and operating a materials department. Many of the papers are followed by verbatim transcriptions of valuable question-and-answer sessions. The book is free to those who attended the conference.

"The Measurement of Particle Size in Very Fine Powders." H. E. Rose. Chemical Publishing Co., Inc., 212 Fifth Ave., New York, N. Y. Cloth, 5 by 7½ inches, 127 pages. Price, $2.75.

Intended for an audience of chemists and engineers working with powdered materials, the book consists of four lectures at the University of London on methods for determining particle shape and size in the range of 1-60 microns. Size frequency and residue curves are discussed and determined. Stokes' Law, elutriation, sedimentation, and thermal insulation apparatus are explained.

Photo-extinction, water analysis, surface determination, and permeability test methods are presented in detail. Specific surface can be determined by the nitrogen adsorption, tinting strength, and bulk density tests; and mean particle size by the use of diffraction rings. Microscopic methods, and margins for human and instrumental error are considered. Tables, graphs, and equations are included to facilitate calculations.

"Degradation of Vinyl Polymers." H. H. G. Jellinek. Academic Press, Inc., 125 East 23rd St., New York 10, N. Y. Cloth, 6 by 9 inches, 329 pages. Price, $8.50.

The third in a series of monographs under the general subject heading of Physical Chemistry, this book is of interest not only to the physical chemist, but also the polymer chemist in the applied chemistry field.

Fundamental mathematical theories of the kinetics of polymer degradation, which may affect only side groups or may concern a major reduction in the size of the macromolecule, are discussed in the first chapter. Among the factors causing reverse or de-polymerization are heat, light, milling, ultrasonic waves, X-rays, nuclear pile radiation, and substances such as oxygen and benzoylperoxide.

Bulk degradation vacuums, and oxidative, chemical, mechanical, and ultrasonic degradation are presented in subsequent chapters. Recently published developments in the field are reviewed and indexed in the 23-page appendix.

"Fiber Glass Reinforced Plastics in the Polyester Laminating Field." Douglas Campbell, James Conklin, and others. FRP Associates, 4 Brattle St., Cambridge 38, Mass. Paper, 8½ by 11 inches, 149 pages. Price $10.00.

A research study submitted by a group of eight students to the Harvard Graduate School of Business Administration, this book purports to evaluate the impact of reinforced plastics on American industry today and in the future.

Following a short historical background review of the field of reinforced plastics, the authors discuss the raw materials used, their preparation and cost, molding and machining processes, and the various engineering properties of the constituent parts. Seven case studies are included: surveying the construction; aircraft; automobiles; boats; military goods; industrial goods; and consumer goods.

A chapter is devoted to the possibilities and requirements for entering the reinforced plastics industry, and the future of the industry as a whole is also considered. Names and addresses of machinery suppliers, consultants, industrial engineers and designers, and manufacturers, weavers, and impregnators of glass fibers are listed in the appendix.

New Literature

"Dow Resin 622 in Surface Coatings." Bulletin CTS-42-6M-1154. Dow Chemical Co., Midland, Mich. 25 pages. Physical properties, solubility, and compatibility of Dow Resin 622 are given in this booklet as well as the preparation by esterification and the effects of fatty acid content, baking schedule, and resin modification. Methods for altering ester viscosity and finishing by air drying and baking are also listed. The bulletin is illustrated with 11 tables and 8 figures.

"Teflon Tetrafluoroethylene Resin." Polychemicals department, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del. 60 pages. This illustrated manual lists the history, general characteristics, manufacture, compositions, uses, and properties of Teflon and describes step-by-step the processing techniques such as molding, ram extrusion, calendering, compounded extrusion, casting and dip-coating, and impregnation. A bibliography and 16 tables are included.

Publications of B. F. Goodrich Co., Cleveland, O.

"Geon 404HI." Service Bulletin G-13. 4 pages.

Physical and electrical properties, chemical resistance, and applications of this high impact strength, rigid PVC resin are given in this bulletin.

"Geon Latex 652." Service Bulletin L-5. 7 pages.

Information is given on physical properties, chemical resistance, applications, compounding, and processing of this vinyl latex which is said to dry to a flexible film at room temperature and require no plasticizer.

"Geon Resin 121 in Plastisol Compounding." Service Bulletin PR-3. 24 pages.

This bulletin covers the flow properties, compounding, preparation and fusion, applications, and processing of this vinyl paste resin. Graphs, illustrations, and tables are included.

"Chemical Progress." Vol. 1, No. 1. Carbide & Carbon Chemicals Co., division of Union Carbide & Carbon Corp., New York, N. Y. 8 pages. The first in a new series of reports concerning chemical developments at the company and throughout the chemical industry, this issue discusses such subjects as the Oxo process for the synthesis of chemicals; the dehydration of natural gas by means of glycols; the lubrication of kiln-car bearings with Ucon synthetic lubricants; and the use of ethyl silicate in precision investment casting.

"Molded Parts of Glass-Reinforced Plastics." Bulletin GRP-1. American Hard Rubber Co., New York, N. Y. 12 pages.

Advantages, applications, properties, strength data, chemical resistance, and design considerations for Ace glass-reinforced molded plastics are given in this bulletin. Materials and molding procedures also are described.

"The 48″ x 42″ Wheelabrator Tumblast." Bulletin No. 124-B. American Wheelabrator & Equipment Corp., Mishawaka, Ind. 8 pages.

A description of the advantages, electrical and mechanical specifications, overall dimensions, and performance of the company's heavy-duty airless blast machine is given in this illustrated bulletin. Parts and method of operation are described in detail.

"Roll Shaft Fatigue Failure." Report No. 5. Rodney Hunt Machine Co., Orange, Mass. 2 pages. Drawings of basic fracture appearances of fatigue failures in roll shafts under load conditons of reversed bending and rotation are contained in this publication.

"Organic Syntheses Based on Ortho-Nitrochlorobenzene." Monsanto Chemical Co., St. Louis, Mo. This is a 35- by 44-inch wall chart showing diagrammatically more than 120 organic syntheses based on ortho-nitrochlorobenzene (ONCB). Also included is a literature summary of potential uses for 19 of the more important ONCB derivatives.

"Bulletin No. 974." American Wheelabrator & Equipment Corp., Mishawaka, Ind. 4 pages. This booklet describes high speed deflashing of molded thermosetting plastic parts with the company's pellet deflasher. Speeds, applications, and companies using the machine are listed, along with a description of the process.

"The 'K' Series." Technical Bulletin #140. Claremont Pigment Dispersion Corp., Brooklyn, N. Y. 8 pages. These data sheets list the properties and applications of the "K" series stir-in calibrated color pastes for vinyl plastisol compounding. Break-down charts are included, giving the heat and light stability, alkali resistance, pigmentation, relative strength of each individual color.

"Series 20000 Liquid-Filled Local Bulb Thermostat." Fenwal, Inc., Ashland, Mass. 2 pages.

Specifications, applications, and a schematic diagram of the company's Series 20000 thermostat are given in this brochure.

"Bakelite Polyester Resins." J-839. Bakelite Co., New York, N. Y. 4 pages.

General properties, compositions, and applications of Bakelite's reinforced plastics are given in this illustrated folder.

"Bakelite C-8 Epoxy Resins and Hardeners." J-763. Bakelite Co., New York, N. Y. 15 pages.

This illustrated booklet describes the properties of Bakelite's C-8 Epoxy resins and hardeners; their compounding with reinforcing materials and fillers; production methods such as casting, potting, and laminating; and their use as adhesives. There is an appended section on release agents for molds.

"Pliovic EDB90V." Techni-Guide PVR-100-8. Chemical division, Goodyear Tire & Rubber Co., Inc., Akron, O. 10 pages.

Physical and electrical properties, dry blending techniques, and use of plasticizers, lubricants, fillers, and pigments with Pliovic EDB90V electrical grade, dry-blending vinyl resin are outlined in this brochure. Charging procedure, formulation, and processing are also described.

"B. F. Goodrich Plastisols." Data sheet 201. Industrial products division, B. F. Goodrich Co., Akron, O. 4 pages.

Methods of manufacture, such as dip coating, slush molding, casting and rotocasting, spreading, and spraying with B. F. Goodrich liquid vinyl plastics, are described in this data sheet. Physical properties, storage life, and the use of heating equipment are also covered.

"Emeryfacts—Specifications and Characteristics." EM-862. Emery Industries, Inc., Cincinnati, O. 4 pages. Specifications of the firm's stearic and oleic acids; animal, hydrogenated, and vegetable fatty acids; oleic esters; special acids and derivatives; and plasticizers are included in this folder.

"Cellosolve and Carbitol Solvents." Carbide & Carbon Chemicals Co., 30 E. 42nd St., New York 17, N. Y. 40 pages. Descriptions of the nine commercial glycol-ethers manufactured by the company, together with performance, test methods, and photographs of applications, are included in this booklet.

"Static Electricity on Plastics." Technical Service Bulletin 1. Logo, Inc., Chicago, Ill. 2 pages.

Methods for controlling static charges which accumulate on plastic surfaces by the use of Logostat anti-static and cleaning agents are outlined in this bulletin. Application by dip, wipe, or spray, as well as methods of handling and storage, dilution, and removal of Logostat compounds are described.

"Standard Samples and Reference Standards Issued by the National Bureau of Standards." NBS Circular 552. National Bureau of Standards, U. S. Department of Commerce. 23 pages. Price, 25¢.

This booklet contains a descriptive listing of the various Standard Samples issued by the National Bureau of Standards, a schedule of weights and fees, and summarized tables of analyses to indicate the type of standards of composition presently available.

Abstracts of Important Articles

Materials

"Trends in Styrene Plastics," Richard B. Bishop, *Modern Plastics,* 32, 6, 154 (Feb. 1955).

Technical advances in styrene polymers, copolymers, and alloys are summarized progressively from raw materials to the finished product, including modifications and molding practices.

"Soluble Polyamide Resins," G. Swann, *Rubber & Plastics Age,* 35, 11, 539 (Nov. 1954). The chemistry of certain polyamides, the modifications required to make them soluble, special properties and applications of soluble polyamides, and their co-condensation with epoxy resins are briefly discussed.

"Tracking Resistance, a Critical Contribution to Operating Techniques," H. Suhr, *Kunststoffe,* 44, 11, 503 (Nov. 1954).

Comparative investigations were made of the procedure for determining tracking resistance. It is explained why and under what conditions the drop and immersion processes occasionally fail to give the same results. ASTM method D495-48T is shown to be in good agreement with the German method. (In German).

"Silicones, Uses and Industrial Applications," H. R. H. Miller, *Can. Plastics,* 51 (Dec. 1954).

Review of the development and uses of silicones as mold releaase agents, greases, cutting oils, abrasion coatings for paper, adhesives, and sizes for glass fibers.

"Creep in Thermoplastics," S. Wintergerst and E. Ruckerl, *Kunststoffe,* 44, 11, 494 (Nov. 1954).

Theroretical considerations of the relation of stress and creep were tested against experiments in which rods of two kinds of Plexiglas were used. The curves obtained were unbroken in some cases and irregular in others, indicating alternate increases and decreases in creep. An explanation of this phenomenon is attempted on the basis of the known behaviour and molecular structure of high molecular solids. (In German).

"Furfural as Raw Material for Plastics," M. M. Mouton, *Rev. Plasticos (Madrid),* 5, 29, 278 (Sept.-Oct. 1954).

Review of the history of furfural, its sources, methods of polymerization, and the production of phenol-furfural condensation materials. (In Spanish).

"Note on the Validity of the Formula Expressing the Relation of Span to Thickness in the Flexing Test," H. Fabre, *Ind. Plastiques Mod. (Paris),* 6, 10, 45 (Dec. 1954).

The author shows what changes are necessary in testing procedure, and in the formula $L = \sqrt{1000h}$ (where L is the span or length of the sample, and h is the thickness) to make the formula more rational. (In French).

"Observations and Suggestions Regarding Mechanical Tests on Plastics," P. Dubois, *Ind. Plastiques Mod. (Paris),* 6, 10, 38 (Dec. 1954).

Alternate flexing is proposed to determine the modulus of elasticity, and a different specimen shape for traction tests than that recommended by ISO/TC/45 on Rubber. The unsatisfactory results noted by some Flex-test investigators in applying the formula $L = \sqrt{1000h}$ receives special attention, and suggestions are offered to make it more workable. The tendency to place more emphasis on breaking load than on yield strength is deprecated. The Charpy impact test method is preferred to the Izod test. (In French).

"Glass Considered as Inorganic Polymer," J. M. Stevels, *Plastica,* 7, 8, 398 (Aug. 1954) and 7, 10, 500 (Oct. 1954).

Since inorganic glasses show typically polymeric characteristics, it was decided to ascertain to what extent they resemble or differ from organic polymers. The net structures of silicate and borate glasses were compared with those of organic polymers, and the relation between structure and physical and chemical properties shown. Glasses and organic polymers have a similar capacity to crystallize. A comparison of the variations in the power factor for both groups of materials, at medium frequencies as a function of temperature, indicated that at low temperatures (up to 100° K.) there is again a high degree of resemblance. At higher temperatures the organic polymers, unlike the glasses, often show pronounced maxima. A possible theoretical explanation of these phenomena is suggested (In Dutch).

Requests for copies, reprints, or further information on any article abstracted in this department should be addressed to the publisher of the magazine where the article appeared. A complete listing of the publishers and addresses of these magazines will be printed here quarterly.
—The Editor

"Polyaddition Resins," V. Supler, *Plaste u. Kautschuk,* 1, 10, 218 (Oct. 1954).

Types of polyaddition reactions, as in the preparation of polyurethanes, epoxy resins, propoxy resins, propoxy resins, and the diallylidene pentaerythrite reaction, are discussed. The chemistry and preparation of epoxy resins are treated in some detail, with emphasis on the various methods of forming the 1,2 epoxide group, and reactions of this group with diols and polyols, diamines and polyamines, dicarboxylic and polycarboxylic acids, and anhydrides, aldehydes and ketones. (In German.)

"Effect of Spherulites on Physical Properties of Fluorothene," F. P. Reding and Alexander Brown, *Ind. Eng. Chem.,* 46, 9, 1962 (Sept. 1954).

During the crystallization process of a polymer such as polychlorotrifluoroethylene (fluorothene), individual crystallites often form in clusters or aggregates called spherulites which can cause cracking along the radii, lack of clarity, embrittlement, and low voltage breakdown potential. To eliminate spherulite formation without reducing crystallinity, various methods can be used such as quenching, cold drawing and adding inert fillers or other miscible resins.

"Polymerization," Herbert F. Wiegandt and Raymond G. Thorpe, *Ind. Eng. Chem.,* 46, 9, 1870 (Sept. 1954).

An annotated bibliography of the 1953 publications dealing with polymerization. Breakdowns are given under the following subject headings: reviews; catalysts, activators, modifiers, and inhibitors; reaction mechanisms and kinetics; ethylenic polymers; elastomers; condensation polymers; and processes, equipment, and plants.

"Epoxy Compounds from Unsaturated Fatty Acid Esters," Ralph J. Gall and Frank P. Greenspan, *Ind. Eng. Chem.,* 47, 1, 147 (Jan. 1955).

Epoxidation reactions have been conducted in situ by adding hydrogen peroxide to an acetic acid solution of unsaturated fatty acid esters in the presence of 2% sulfuric acid, at 60-70° C. Optimum yields of epoxy compound were formed with a molar ratio of 0.5 acetic acid to 1 of ethylenic unsaturation in the presence of an inert solvent such as benzene. Other experimental applications are described, along with tables showing various epoxy yields.

"True Plastigels Based on PVC," J. Delorme, *Ind. Plastiques Mod. (Paris),* 6, 8, 45 (Sept.-Oct. 1954) and 6, 9, 45 (Nov. 1954).

The first part of an article on "true plastigels" obtained with special types of PVC where the particles fix all the plasticizer added by surface absorption without the need for a gelling agent. The plastigels are claimed to be heat stable, not to run, and to undergo no deformation even at 165° C. when subjected to no other strain but weight. They can be processed by the same techniques as for asphalt or tar-based moldings, with due consideration to the effects of temperature. (In French).

"Dielectric Breakdown of Thermosetting Laminates," M. A. Skow, *Modern Plastics*, 32, 4, 152 (Dec. 1954).

Safe operating loads for several grades of thermosetting plastic laminates were established by tests for the endurance limits of dielectric strength, plotting voltages against time. Results also showed that a maximum voltage exists below which failure will not occur for a given thickness and atmospheric condition.

"Plastics Testing at High and Low Temperatures," C. H. Klute and L. B. McKee, *ASTM Bull.*, 202, 50 (Dec. 1954).

The modifications of equipment which are required to conduct mechanical tests, such as strength properties, with a 60,000-pound universal testing machine having a −70 to +500° F. range, and with a low-temperature impact tester are described along with methods for maintaining uniform temperatures during testing.

"Measurement of Creep and Acrylic Glazing Plastics Exposed to Temperature Gradients," Murray C. Slone and Frank W. Reinhart, *SPE J.*, 10, 10, 29 (Dec. 1954).

A test for measuring creep of two acrylic plastics under tensile stress and temperature gradient is outlined, along with a statistical analysis of the test results and tables for correlating the data obtained.

"Stabilization of Polyesters to Light," Russell T. Dean and Joseph P. Manasia, *Modern Plastics*, 32, 6, 131 (Feb. 1955).

The effects of stabilizers, catalysts, and other additives and factors on the yellowing degradation of polyester-fibrous glass panels, brought about on prolonged exposure to ultra-violet light, are reported and tabled in this article.

"Flow Properties of Vinyl Chloride Resin Plastisols," E. T. Severs and J. M. Austin, *Ind. Eng. Chem.*, 46, 2, 2369 (Nov. 1954).

High speed coating subjects vinyl chloride resin plastisols to high rates of shear. Their viscosities can be measured by an extrusion rheometer, and predictions made of their flow properties for specific applications.

"Highly Intense Radiation Fields," David S. Ballantine, *Modern Plastics*, 32, 3, 131 (Nov. 1954).

Initiation of polymerization by alpha, beta, and gamma rays, as well as neutron initiation, has been investigated in the hope of synthecizing new polymers and improving the physical properties of presently existing resins. Gamma radiation offers the advantage of low temperature initiation in the solid state without catalyst fragment contamination.

"The Effect of the Addition of Various Substances on Unsaturated Polyester Resins," B. Berndtsson and L. Turunen, *Kunststoffe*, 44, 10, 450 (Oct. 1954).

With styrene-modified resins as example, the authors define the term "unsaturated polyester resin," and explain the hardening process. The catalysts which excite the reactivity of double-bonds, and the accelerators which support this radical formation are dealt with in detail. Other points discussed are the effect of styrene concentration on gelling time, properties of the hardened resin, and the effects of filler and pigments on various factors in the processing and use of the polyester resins. (In German).

"Spinnable Glass Fibers as Reinforcement for Plastics," F. Brockmoeller, *Kunststoff*, 44, 10, 425 (Oct. 1954).

The various types of fibers, their proper selection with regard to ultimate use, and characteristics of glass fabrics and weaves are described as well as the use of staple fiber and spun staple yarn as reinforcing fillers. Technical hints are given on the manufacture of pre-impregnated glass fiber mats and fabrics that can be stored. (In German).

"Glass-Fiber Reinforced Plastics," W. Beyer, *Kunststoffe*, 44, 413 (Oct. 1954).

Over-optimistic promotional reports have tended to minimize the problems involved in processing these materials, thus giving rise to unrealizable expectations and consequent failure which, in turn, bred unduly adverse opinion of methods and product. Mainly to correct this, the author presents an easy-to-understand discussion of the basic raw materials, the mechanical properties of the plastic, the processsing technology, and fields of application. (In German).

"Importance of a Type Object in Testing Plastic Materials," P. Dubois, *Ind. Plastiques Mod. (Paris)*, 6, 9, 39 (Nov. 1954).

The advantages of carrying out mechanical tests on a type object instead of on the usual small bars and plates are discussed from the scientific, technological, and cost standpoints. (In French).

"Polymeric Plasticizers," G. R. Kloos, *Kunststoff*, 44, 10, 429 (Oct. 1954).

Polymeric plasticizers, consisting of the higher molecular polyesters of saturated bi-functional fatty acids and glycol, were tested for resistance to extraction with various types of solvents. By comparison with dioctyl phthalate, tricresyl phosphate and dioctyl sebacate, these polymeric materials (adipic acid polyester and sebacic acid polyester) gave considerably better results in all cases; the higher molecular weights being accompanied by greater resistance to extraction. (In German).

"Creep Properties of Three Plastics," William N. Findley, *Modern Plastics*, 32, 3, 150 (Nov. 1954).

Results of tension creep tests at 70° F. and 50% relative humidity show the effect of degree of crystallization of polychlorotrifluoroethylene, residual stress of polyvinyl chloride sheets, and aging of canvas laminate.

"The Quantitative Analysis of Urea Formaldehyde Condensation Products," L. M. Mobers, *Plastica*, 7, 12, 598, and 8, 1, 16 (Dec. 1954 and Jan. 1955).

The methods of analysis are discussed, including the determination of water content, formaldehyde and methulolformaldehyde. Dimethylene ethers are components of concentrated solutions of the condensation products of urea formaldehyde, which readily decompose on dilution with water. It is suggested that this may offer an acceptable explanation for the viscosity anomalies of some urea-formaldehyde condensation products. Dialysis and paper chromatography are also described as useful methods of separation. (In Dutch).

"Mixed Plasticizers in Vinyl Chloride Resins," L. H. Wartman, *Modern Plastics*, 32, 6, 139 (Feb. 1955).

To obtain the most desirable properties in plasticized vinyl compounds, it is often advantageous to use more than one plasticizer. Test results on brittle temperature, SPI volatility, plasticizer rub-off, and nitrocellulose marring permit predicting the properties of a mixed-plasticizer compound by comparing concentrations of the individual plasticizers to their values when compounded.

"Heat-Resistant Allyl Resins," Howard W. Starkweather, Jr., Arnold Adicoff, and Frederick R. Eirich, *Ind. Eng. Chem.*, 47, 2, 302 (Feb. 1955).

A strong, transparent plastic casting material which will withstand temperatures to 200° C., is needed for applications such as aircraft glazing. Copolymers of triallyl cyanurate and diethylene glycol bisallyl carbonate have been found superior to diallyl phthalate and diethylene glycol bisallyl carbonate in casting technique, heat-distortion tests, and ball drop tests.

"Weathering of Polyvinyl Chloride," J. B. DeCoste and V. T. Wallder, *Ind. Eng. Chem.*, 47, 2, 314 (Feb. 1955).

Vinyl coatings for telephone wire and cable have proved successful indoors. Results of tests for outdoor weathering, using special formulations with light shielding pigments, are reported in this article. Special stabilizers and plasticizers were used, and tests were conducted under natural and accelerated weathering conditions.

"Cured Polyvinyl Formal Sheet," M. M. Sprung, F. O. Guenther, and M. T. Gladstone, *Ind. Eng. Chem.*, 47, 2, 305 (Feb. 1955).

Fabrication and cure of polyvinyl formal sheet involves thermal or chemical crosslinking reactions, thereby increasing its heat stability. Experiments using various crosslinking agents are reported, and curing schedules, thermal stability studies, milling and pressing procedures, dimensional changes, and weight loss are also reported.

"Casting Resins Containing Polystyrene," Paul Ehrlich, R. W. Tucker, and P. J. Franklin, *Ind. Eng. Chem.*, 47, 2, 322 (Feb. 1955).

Electrical and physical properties of FN-2.5, a copolymer containing fumaronitrile as the reactive comonomer, and other resins used for casting or potting electronic equipment, are reported and evaluated. It was found that the alternating current behavior was determined by the response of the dipoles in the polymer to the field. The loss maxima increase with the number of dipoles and the square of their moment.

"Determination of the Degree of Cure of Polyester Resins," B. Parkyn, *Brit. Plastics*, 28, 1, 23 (Jan. 1955).

A discussion of the meaning of the term "degree of polymerization of a polyester resin," the effect of undercuring on the physical characteristics of a glass fiber-reinforced polyester laminate, and some of the causes of undercuring. Work carried out to develop a reliable test procedure to determine the degree of cure of a polyester is described, and some results given on the effect of degree of cure on cross-breaking strength, Young's modulus, loss angle, dielectric constant, hardness, and specific gravity.

Equipment

"Experiences with High-Frequency Preheating of Heat-Hardenable Plastics," W. Hasel, *Kunststoffe*, 44, 11, 528 (Nov. 1954).

Experiments are described which demonstrate the advantages of high-frequency preheating for processing and for improving quality. Rules, based on practical experience, are given for the selection, use, and maintenance of high-frequency preheaters. (In German).

"Plastic Dies Move into Regular Production Service," George C. Adams, *SPE J.*, 11, 1, 19 (Jan. 1955).

Plastic draw dies, stretch dies, drop hammer dies, laminating molds, and post-forming dies are described and illustrated, along with a discussion of plastic tooling for the future.

Processing

"Rigid Thermoplastic Sheeting," Norbert Platzer, *Modern Plastics*, 32, 3, 144 (Nov. 1954).

Forming of rigid thermoplastic sheets has an effect on the physical properties of the finished article. A series of experiments in establishing the optimum forming temperature, and a study of the effects of stretching on the properties of the sheet, are reported.

"Bag Molding" D. L. Ridenour, *SPE J.*, 10, 10, 35 (Dec. 1954).

Vacuum rather than pressure bag molding is desirable to produce economical glass fiber reinforced polyester parts which do not require high molding pressures nor high reinforcement content. A full description of the molds and auxiliary equipment is given.

"Application of New PVC Types Free from Emulsifiers and Electrolytes," W. Klein, *Kunststoffe*, 44, 11, 498 (Nov. 1954).

In Germany, PVC is produced for the most part by the emulsion-polymerization process and with K-values of 50 to 80, in contrast to American practice which employs the suspension process yielding products with K-values of 70-80. Chemische Werke Huls has produced Vestolit, a suspension PVC with K values of 55, 60, and 65, and without emulsifier or electrolyte. Processing techniques for plasticized and rigid forms of the Vestolits in tubing, sheets, deep-drawn parts, blown bottles, and wire and cable insulation are discussed. (In German).

"Vacuum Forming and Drape Molding," P. A. Sauter, *Brit. Plastics*, 27, 11, 420 (Nov. 1954).

The advantages and applications of the drape forming method are compared with those of vacuum forming with Formvac machines. These machines have 14-inch draw depths; a special sheet cooling system which permits stripping of formed sheets at the highest possible temperature; and twin tables. The surge tank has been discarded and a specially designed, high capacity vacuum pump is connected directly to the mold table.

"Quality Control in the Plastics Industry," Joseph Manuele, *Plastics World*, 12, 12, 6 (Dec. 1954).

Attributes inspection, 100% product screening, and "machining to size" are rarely required when effective quality control is instituted. In plastics molding, average dimension and deviation of each cavity should be carefully determined.

"Balanced Gating," David A. Jones, *Modern Plastics*, 32, 4, 134 (Dec. 1954).

Gate dimensions for multi-cavity molds or for multi-gated, single-cavity molds can be calculated by means of a mathematical formula, whereby a single numerical value is determined which represents the weight of plastic flowing through the gate.

"Injection Molding Polystyrene," J. Burnie, *Can. Plastics*, 60 (Dec. 1954).

Review of the factors in the design of machine components and in procedure that are important for the production of superior parts with a minimum of rejects and at low cost. In Canada, the demand for higher capacity injection machines is slowing down due to the high cost of molds, and the expected competition from vacuum forming.

"Post-Forming of Thermosetting Laminates," St. John Bain, *Plastics World*, 12, 11, 10 (Nov. 1954).

Thermosetting laminated plastics can be post-formed by uniformly heating them to within the narrow temperature range between blistering and cracking, then immediately forming them in a die such as an air cylinder press. The bending limitations are determined by the grade of the thermosetting laminate used.

"The Processing of Unsaturated Polyester Resins," H. Weisbart and E. Behnis, *Kunststoffe*, 44, 10, 447 (Oct. 1954).

The important factors in processing unsaturated polyesters are dealt with, chief among which are the properties of the resin and glass fibers used. Cold and hot hardening methods are discussed, with emphasis on the proper selection of mold release agents, catalysts, fillers, and colors. (In German).

"Economy in Record Molding," Clay Galehouse, *Modern Plastics*, 32, 3, 1[illegible] (Nov. 1954).

Production economy can be achieved in the manufacture of brightly colored phonograph records for children by using a centrifugal mixer for dry coloring the styrene molding material, and employing an automatic molding system for mass production.

"Some Practical Aspects of the Manufacture of Forms from Plastics," S. Matthews, *Plastics*, 368 (Nov. 1954).

After outlining the factors governing the life of plastic tools for forming mild steel and explaining why the development of dies from polyester-fiberglass laminate was abandoned, the author describes the method now in use by the Briggs Motor Bodies Ltd., for manufacturing temporary plastic dies for this purpose. A core is cast from a mixture of 20 parts by weight of epoxide resin catalyst and 100 parts by weight of silica sand 30-40 mesh, and faced with a mix containing equal parts by weight of aluminum silicate and epoxide resin catalyst, and a small amount of graphite.

"Heat Flow Through Plastics Materials," Victor Paschkis, *SPE J.*, 10, 9, 28 (Nov. 1954).

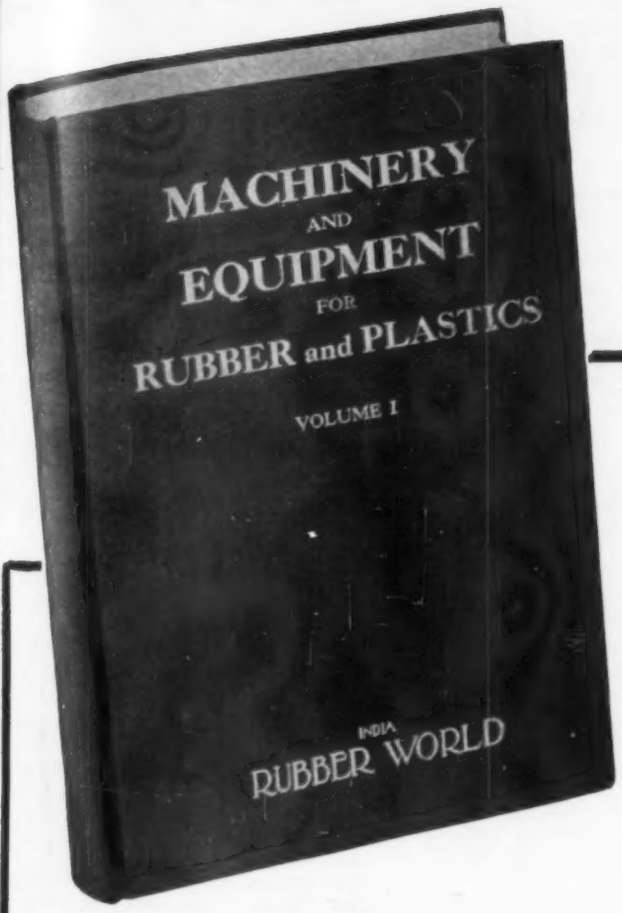
A technique for solving heat flow problems in the manufacture of plastics by electric analog computers, instead of trial and error, is presented along with a discussion of some of the related problems in the plastics industry.

"Decoration of Thermoplastics," John I. Graham, *Modern Plastics*, 32, 4, 12[illegible] (Dec. 1954).

Cooperation among designers, molders and finishers can result in more satisfactory production of decorated plastics parts as well as greater economy of manufacture.

"Vacuum-Forming of Thermoplastic Sheet in Canada," G. W. Beatty, *Can. Plastics*, 48, (Dec. 1954).

The high cost of capital equipment and of dies, combined with small production runs and relatively low tariffs, have made it impossible for Canada to meet competition from the United States in some sections of the plastics industry. Vacuum forming of plastic sheet, particularly of styrene copolymer, is held to be the



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answer to these problems, and the special advantages and possibilities of the process for the Canadian industry are presented.

"Specifications for Use under Statistical Quality Control," Dorian Shainin, *SPE J.*, 11, 1, 13 (Jan. 1955).

Quality control is concerned with production, not inspection, but definite and realistic specifications can be used to find the variable factors responsible for production costs. Average Outgoing Quality Limit, Acceptance Quality Level, and Lot Tolerance Percent Defective should be included in these factors.

"The Concept of Control Charts, Part I," Delmer C. Dague and John D. Hinchen, *SPE J.*, 10, 9, 22 (Nov. 1954).

Examples, tables, and formulas for adapting the Control Chart for Individuals and the Central Limit Theory to quality control by means of the shewhart Average and Control Charts are given in this article, which is the third in a series of articles on "Better Products with Statistical Quality Control."

"The Concept of Control Charts, Part II," Delmer C. Dague and John D. Hinchen, *SPE J.*, 10, 10, 21 (Dec. 1954).

Quality control of variables in terms of chance variation, binomial expansion and distribution, frequency distribution, binomial probability, average fraction defective, and Poisson distribution, is explained in this article; part two of the third article in a series on "Better Products with Statistical Quality Control."

"Sampling Inspection," Dorian Shainin, *SPE J.*, 11, 2, 22 (Feb. 1955).

Successful sample inspection depends upon the taking of a truly representative sample. Sample size, not lot size, gives a truer picture. Random sampling, numerical risks, and the limiting risk concept are discussed, and some practical sampling plans are offered.

"Avoiding Sink Marks, Bubble Formation, and Stresses in Thick-Walled Thermoplastics or Those with Walls of Widely Different Thicknesses," H. Volland, *Kunststoffe*, 44, 11, 525 (Nov. 1954).

Production methods are reviewed, and the sources of defects discussed. It is suggested the usual difficulties can be largely eliminated by a procedure involving the use of a pin-point gate with antechamber and special nozzle. (In German.)

"Practical Experience with the Molding Technique for Polyester Resins, Especially the Pre-Form Method," L. Goerden, *Kunststoffe*, 44, 10, 437 (Oct. 1954).

A number of helpful hints are given, gathered from recent experience in Germany on the pre-form method for molding polyesters. Emulsions are recommended as the bonding material. While American literature frequently mentions molding pressures under 10 kg./sq. cm., the author finds fewer rejects at pressures from 10-20 kg./sq./cm. and temperatures from 105-115° C. Satisfactory glass silk is now available in Germany, as is an efficient pre-form machine. (In German).

"Dust Irritation Problems," Roger B. White, *Modern Plastics*, 32, 3, 129 (Nov. 1954).

Simple vacuum exhaust systems and dip washings in a solvent such as naphtha help considerably to cut down in reinforced plastics fabrication. Workers should be advised that extensive investigation by medical authorities has shown skin irritations from the dust to be superficial and transitory.

"When and How to Hob," Islyn Thomas and Edmund Spitzig, *Modern Plastics*, 32, 6, 117 (Feb. 1955).

The entire hobbing process is described and illustrated, along with a listing of its advantages and disadvantages in forming multiple mold cavities. Hob design and preparation of the blank are also discussed.

"The Granulation of Polythene," A. Kennaway, *Brit. Plastics*, 28, 1, 18 (Jan. 1955).

Methods of granulating plastics are described, in particular the latest developed at Imperial Chemical Industries, Ltd., in which so-called "spaghetti-cutting" is carried out on the extruded material while it is still in the molten state, resulting—especially with Polythene—in the formation of uniform spheroids. The product will shortly be marketed under the trademark Caviare or Cariare Cut.

Applications

"Plastic Material Problems in Power Distribution," Barney Kellam, *SPE J.*, 10, 9, 17 (Nov. 1954).

Polyvinyl chloride insulation and sheathing of single and multi-conductor control cable in near-vertical position, and therefore under "cold flow," was fastened by a brass strip covered with vinyl adhesive tape. Laboratory tests showed this type of fastening to be as effective as metal grippers. A PVC-sheathed polyethylene cable proved to be economical, readily operable, and impervious to environmental cracking.

"Friction and Lubrication of Nylon," R. C. Bowers, W. C. Clinton, and W. A. Zisman, *Ind. Eng. Chem.*, 46, 2, 2416 (Nov. 1954).

Nylon has been used extensively in the production of gears and bearings due to its mechanical properties and its abrasive and chemical resistance. Long-chain aliphatic lubricants adsorbed at the surface decrease the real area of contact and the adhesion of the two rubbing surfaces. A steel-nylon combination is easier to lubricate than nylon alone because close-packed films can be formed more readily on metals.

"Plastic Auto Body Developments," William A. Hermonat, *SPE J.*, 10, 9, 31 (Nov. 1954).

Fabrication techniques using both plastic and metal tooling, mold preparation, and matched dies are reported. "Shellcoat" application is required to achieve high quality finish.

"The Application of Unsaturated Polyester Resins, with Special Consideration to the Use of Single-Part Molds," B. S. Parkyn, *Kunststoffe*, 44, 10, 439 (Oct. 1954).

Of the seven methods for producing glass-reinforced plastics, that using one-piece molds is discussed in detail. Descriptions are given of the manufacture of car bodies, boats, corrugated ceiling panels, ventilating piping, and other parts, as well as the economics of the different processes. (In German).

"Plastic Pipe in the Chemical Processing Industry," B. W. Bender and J. W. Hawley, *SPE J.*, 11, 1, 16 (Jan. 1955).

Plastic piping has begun to gain volume acceptance in the handling of corrosive chemicals, deionized and demineralized water, and contaminates. Six basic types are available, all with certain limitations which must be considered for successful application. Sizes, fittings, and methods of joining are also discussed.

"The Economical Significance of Plastics for Packaging Purposes," J. Claus, *Plastica*, 7, 12, 594, and 8, 1, 8 (Dec. 1954 and Jan. 1955).

The applications of various types and forms of plastics for packaging, coatings, and adhesives for packaging. (In Dutch.)

"Plastisols in Packaging," Don M. Taylor, *Can. Plastics*, 38 (Jan. 1955).

A discussion of plant costs, formulations, and the methods of packaging metal parts; the preparation of wraps, foil packs and coated cartons; the lining of cans, and the projected lining of large containers for chemicals, to replace glass carboys; and the over-spraying of fragile containers for pharmaceutical uses.

"Cellophane Packaging Materials," U. Ostwald and R. Weingand, *Kunststoff-Rundschau* 1, 10, 297 (Oct. 1954).

After reviewing the rapid growth in the production and use of cellophane for packaging, the authors discuss the processing and ingredients required to give the necessary transparency and strength, as well as the relation of atmospheric humidity to moisture content and mechanical properties of the films. Methods of testing are also described. (In German.)

"The Use of Plastics in Advertising," B. W. Cattens, *Australian Plastics*, 10, 111, 34 (Oct. 1954).

The use of acrylic plastics, rigid and plasticized PVC, Scotchlite fluorescent paints, etc., in display work, posters, sales promotion articles, and the like is discussed.

"New Developments for Plastic Compounds," A. Foulon, *Plastverarbeiter*, 5, 11, 366 (Nov. 1954).

Recent developments in the use of plastics in the manufacture of musical instruments; seamless, spread-on flooring; Bayer's fast-color, spin-dyed Perlon fibers; Siloprene products; and Vestan synthetic fiber. (In German.)

"Metal-Bonding Adhesives with Improved Heat Resistance," John M. Black and R. F. Blomquist, *Modern Plastics*, 32, 4, 139 (Dec. 1954).

A formulation of phenol and epoxy resins modified with hexamethylenetetramine produces a metal-bonding adhesive with greater resistance to temperatures up to 600° F.

"Rilsan in Packaging and Conditioning," R. Dumon, *Ind. Plastiques Mod. (Paris)*, 6, 10, 7 (Dec. 1954).

Rilsan, a superpolyamide with a relatively large plasticity zone (about 190-200° C.), is discussed with respect to its properties and uses in coating metal surfaces by flame-spraying; for bottles made by molding, blowing or extrusion; for bottle caps and seals by injection molding; and for transparent foils made by extrusion and blowing. (In French.)

"Synthetic Resins in Plastics-based Lacquers and Finishes. I-Alkyd Resins," C. Rothgen, *Kunststoff-Rundschau*, 1, 10, 304 (Oct. 1954).

Alkyd resins combine with almost all naturally-occurring oils, fats, and fatty acids, as well as with various synthetic resins. A number of combinations to achieve various types of finishes for different purposes are discussed. (In German.)

General

"Plastics in 1954," E. E. McSweeney and E. L. Kropa, *Chem. Eng. News*, 33, 1, 16 (Jan. 1955).

A survey of the plastics industry in 1954, this article points out that although there was very little activity in the introduction of new resins and materials, considerable new capital has been attracted into new installations for the production of raw materials and intermediates. An analysis by product is given.

"Where do we Stand in Plastics Development?" R. Gath, *Kunststoffe*, 44, 11, 490 (Nov. 1594).

In considering the importance of close cooperation between science and industry, the economic aspects of plastics development are stressed. The disrupting effects of the war on progress in Germany are considered, and requirements are outlined for new advances in the future, such as the need for improved manufacturing methods, and availability of raw materials. (In German).

Current Market Prices

Corrections and Additions

Adhesives

Ampcoflex Adhesive	qt.	$2.75	$3.50
Epoxy Adhesive A-1, A-3, A-4	qt.	4.45	6.90
A-2, A-5	qt.	5.60	8.00
A-6	qt.	5.80	8.00
C-1, C-2, C-3, C-9	qt.	5.60	8.00
C-4, C-7	qt.	3.69	5.30
Flexible Resin No. 1	qt.	4.45	6.90
Melmac 401	lb.	.45	
421	lb.	.45	.47
Melurac 300, 302	lb.	.25	.29
301	lb.	.28	.33
Urac 110	lb.	.205	.225
115	lb.	.27	.29
180	lb.	.105	.125
185	lb.	.1875	.2275
186	lb.	.0825	.1075
192	lb.	.65	

Catalysts

Advasol	lb.	.4375	.5375
Catalyst 57	lb.	.12	
196	lb.	.10	
C-110, -180, -180-S, C-110-S, WF-100, -101	lb.	.12	
Hardener 181, 185, 185-S 184, M-325	lb.	.12	
H C Promoter 6%	lb.	.5275	.6275
12%	lb.	.9025	1.0025
Melurac 255, 259	lb.	.35	
Modifier CB-110, WF-61	lb.	.15	
SA Hardener	lb.	.10	
Soligen	lb.	.4825	.5825

Colors

Aquablaks	lb.	.085	.235
Claremont D-Series pastes, Blacks	lb.	.47	.68
Blues	lb.	.62	1.55
Golds	lb.	2.31	2.49
Green	lb.	1.86	1.88
Oranges	lb.	1.70	3.65
Reds	lb.	1.10	2.57
Silver	lb.	.89	.91
Whites	lb.	.45	.60
Yellows	lb.	.55	1.68
K-series pastes, blacks	lb.	.58	.71
Blues	lb.	.91	1.40
Browns	lb.	.53	
Greens	lb.	.94	1.41
Metallics	lb.	.91	2.47
Orange	lb.	.80	3.84
Reds	lb.	1.03	5.07
Violet	lb.	2.30	
Whites	lb.	.59	.60
Yellows	lb.	.73	3.02
Codispersions	lb.	.23	.24
Covinylblaks	lb.	.68	1.145
Cowaxblaks	lb.	.4075	.6075
IVO bone blacks	lb.	.16	.2175
Laminac color pastes	lb.	.66	1.90
Mapico blacks, crimsons, reds	lb.	.1275	.13
Browns	lb.	.1375	.14
Tans	lb.	.2025	.205
Yellows	lb.	.105	.1125
Sherwin-Williams Dispersed Colors	lb.	.55	1.97
Inorganic colors, oranges, yellows	lb.	.32	.45
Organic colors, blues	lb.	.90	3.60
Greens	lb.	1.35	3.95
Reds	lb.	.85	4.40
Yellows	lb.	.53	1.97
Vinylized colors, blacks, whites	lb.	.755	
Blues	lb.	1.16	1.18
Golds	lb.	1.51	1.57
Green	lb.	1.45	
Metallic	lb.	1.15	
Orange	lb.	.83	
Reds	lb.	1.15	2.27
Yellows	lb.	.76	1.09

Fillers

Cab-o-sil	lb.	.68	.75

Miscellaneous

Advaresin C X F	lb.	.49	.55
K F	lb.	.40	.46
Dutch Boy Bentone	lb.	.44	.60
Ben-A-Gel	lb.	.98	1.40

Molding Compounds & Resins

Acrylic

Cadco cast rods	lb.	1.83	6.96
Polished	lb.	1.99	7.16
Machined rods	ft.	22.00	89.54
Tubes	lb.	1.39	5.76
Polished	lb.	1.51	5.99
Colors	lb.	1.62	5.99
Pearl	lb.	1.99	6.76

Melamine

Melmac 402	lb.	.51	.53
404R, 404T	lb.	.85	.95
405	lb.	.45	.52
428	lb.	.48	.55
430	lb.	.465	.535
440	lb.	1.10	
480	lb.	.265	.315
1077, 1079	lb.	.47	.75
1500	lb.	.42	.55
1502	lb.	.45	.58
3020	lb.	.57	.72
3024-A	lb.	.67	
3135	lb.	.90	1.10
P-592, -592-A	lb.	.65	.75

Phenolic

91-LD	lb.	1.50	2.50
Cyacor 151	lb.	.215	.235
191	lb.	.13	.16
Reilly general purpose	lb.	.195	.20
Heat & impact resist	lb.	.20	.205

Polyester

Laminac 4110, 4116, 4123	lb.	.35	.365
4111	lb.	.45	.465
4119	lb.	.43	.445
4120	lb.	.40	.415
4128	lb.	.37	.385
4134	lb.	.46	.475
4146, 4202	lb.	.55	.565
4192	lb.	.365	.38

Polyethylene

Reynolon 1000, P series	lb.	.60	.80

Urea

Beetle C-4980, T-298	lb.	.1875	.30
MUP series, powder	lb.	.30	.49
Special colors	lb.	.30	.59
Granules	lb.	.33	.52
Special colors	lb.	.33	.62

Vinyl

Reynolon, 4000 series	lb.	1.55	2.30
Rolls, 1-mil	sq. yd.	.0625	.11
Colors	sq. yd.	.0675	.08
4-mil	sq. yd.	.215	.3125
Colors	sq. yd.	.2375	.255
16-mil	sq. yd.	.81	1.19
Colors	sq. yd.	.86	.945

Plasticizers

Dutch Boy Plasticizer NL-A10 (DBP)	lb.	.30	.33
NL-A20 (DOP,) NL-A30 (DIOP)	lb.	.305	.335
NL-C20 DOS)	lb.	.61	.63
NL-F21	lb.	.395	.425
NL-F31	lb.	.44	.47
NL-F41	lb.	.48	.51
NL-A54	lb.	.295	.325
Harflex	lb.	.64	.84
Plasticizer 120	lb.	.44	.49
Plastoflex #3	lb.	.52	.57
#520	lb.	.36	.435
D B E	lb.	.50	.55
MGB	lb.	.32	.40
SP-2	lb.	.43	.48
VS	lb.	.40	.4775

Stabilizers

Advastab #3, #52, OM-10	lb.	1.90	2.00
17-M	lb.	3.00	3.25
#21	lb.	1.00	1.18
#21 new, #143, E-6-B	lb.	.80	.90
#42	lb.	.83	.93
89-X	lb.	.75	.80
BA-13-P, BC-105	lb.	.75	.85
BC-12	lb.	.87	.95
C-77	lb.	.85	.95
CH-14, -20	lb.	.63	.70
E-49	lb.	.60	.65
E-98	lb.	.55	.65
JCX	lb.	.62	.68
L paste	lb.	.65	.70
OM-18	lb.	3.10	3.35
P-1835, T-72	lb.	3.20	3.35
PS-38, ZN-9	lb.	.50	.65
SN	lb.	.47	.53
V-1-N	lb.	.40	.48
VL-3	lb.	.95	1.05

Wetting Agent

Advawet X-212	lb.	.50	.55

Patent Digest

Materials

Thermoplastic Casting Compositions. No. 2,700,185. Max M. Lee, Washington, D. C. (to the United States of America).

An electrical insulating and potting composition is composed of 30-60% styrene monomer, 20-35% filling and shrinkage controlling material such as a styrene-butadiene, 0.5-30% divinylbenzene as a cross linking agent, about 15% miscible plasticizer, 0.1-1% organic peroxide catalyst, and 0.01-0.3% heterocyclic amine and a metallic naphthenate drier.

Process of Catalyzing a Polymerization Reaction Utilizing a Liquid Water-Insoluble Catalyst Emulsion. No. 2,698,311. Jack D. Robinson, Darien, Conn. (to American Cyanamid Co., New York, N. Y.).

An emulsion of tertiary butyl perbenzoate, water, and emulsifying agent is mechanically dispersed in an aqueous emulsion of polymerizable polyester of a polyhydric alcohol, an ethylenically unsaturated polycarboxylic acid, and a material having an ethylenic grouping. The mixture is heated to evaporate the water and cure the catalyst-containing polymerizable fraction.

Process for Preparing Polysulfone Resins. No. 2,698,317. Stanley E. Ross, Clifton, N. J., and Herman D. Noether, Kew Gardens, N. Y. (to Celanese Corp. of America, New York, N. Y.).

An olefinic compound copolymerizable with sulfur dioxide is added to an organic hydroperoxide polymerization initiator with an excess of cooled sulfur dioxide. An inert gas is bubbled through to effect copolymerization in the liquid state.

Furfuryl Alcohol Polymer and Continuous Process for Making the Same. No. 2,698,319. Lloyd H. Brown, Oak Park, and Preston A. Wells, Jr., Winnetka, Ill. (to Quaker Oats Co., Chicago, Ill.).

A mixture of furfuryl alcohol and dilute phosphoric acid is passed through a polymerization zone at a temperature of about 110-125° C. for approximately 15 minutes. The effluent is neutralized to pH 5-6 and distilled, leaving the polymer as a liquid residue. The furfuryl alcohol is returned to the polymerization zone.

Catechols Containing a Substituent in the 4-Position as Gelation Inhibitors in Polyester Mixtures. No. 2,698,312. Earl E. Parker, Milwaukee, Wis. (to Pittsburgh Plate Glass Co., Allegheny County, Pa.).

A new composition consisting of a polymerizable mixture of a polyester of dihydric alcohol and an ethylenically unsaturated dicarboxylic acid, and sufficient 4-n-butyl catechol to stabilize the mixture.

Self-Extinguishing Composition of Cellulose Acetate and Benzene Hexachloride. No. 2,698,806. William P. ter Horst, Lewiston, N. Y. (to Olin Mathieson Chemical Corp., Baltimore, Md.).

The composition consists essentially of cellulose acetate and from about one weight per cent to its limit of compatibility of benzene hexachloride.

Coating Compositions Containing Ethyl Cellulose and a Process of Making the Same. No. 2,698,807. Annis G. Asaff, Auburndale, Mass. (to Callaghan Hession Corp., Boston, Mass.).

A plastic coating composed of water-immiscible gel is formed by adding sufficient water to effect a two-phase separation to a solution of ethyl cellulose and a mixture of less than 80% liquid aromatic hydrocarbons and more than 20% alcohol. Percentages are by weight, and the alcohol is selected from a group comprising methanol, ethanol, normal propanol, and isopropanol.

Heat Resistant Oxalate-Alkyd-Isocyanate Cellular Plastics. No. 2,698,838. Eli Simon, Los Angeles, and Frank W. Thomas, Burbank, Calif. (to Lockheed Aircraft Corp., Burbank, Calif.).

An alkyd resin prepared from oxalic acid, and a polyhydric alcohol (reacted at temperatures below 275° F. to have an acid number of 5-175) are combined to form a cellular reaction product wherein the hydroxyl groups and carboxyl groups of the alkyd resin reactants are in the ratio range of from 3(OH):1(COOH) to 4(OH):5(COOH); and containing 35-150 parts by weight of meta-toluene diisocyanate for each 100 parts by weight of resin, and 0.03-15 parts by weight for each 100 parts of metal-toluene diisocyanate of a film-forming and foam-stabilizing thermoplastic resin additive. The additive must be soluble in the diisocyanate.

Printed copies of patents are available from the Commissioner of Patents, Washington 25, D. C. Price, 25c each.

—The Editor

High Impact Strength Plastic Composition Containing Polyvinyl Acetyl Resin and Chlorosulfonated Polyethylene Elastomer. No. 2,693,459. Charles F. Fisk, Clinton, N. J. (to United States Rubber Co., New York, N. Y.).

A gum plastic mixture containing 4-15% chlorosulfonated polyethylene rubber, and 85-96% polyvinyl acetyl resin characterized by 75% aldehyde replacement of the acetate ester groups.

Start-up Polymerization of Acrylonitrile. No. 2,693,462. Algernon P. Guess and William B. McCaskill, Camden, S. C. (to E. I. du Pont de Nemours & Co., Wilmington, Del.).

A process for initiating the polymerization of acrylonitrile by increasing the rate of catalyst feed to monomer feed and the ratio of activator feed to monomer feed 10-40% in the early stages, then gradually decreasing the ratios to their respective values in constant environment polymerization.

Polysiloxane Resin Compositions. No. 2,695,276. David B. Hatcher, Toledo, O. (to Allied Chemical & Dye Corp., New York, N. Y.).

A composition containing a synthetic resin ester having a silicon atom attached to a hydroxy group, combined with a fatty acid-modified condensation polymer.

Solutions of Acrylonitrile Polymers Containing an Inorganic Acid. No. 2,695,278. John L. Justice, Chester, Pa. (to Chemstrand Corp., Decatur, Ala.).

A new acrylonitrile polymeric solution is described which contains an organic solvent and an inorganic acid in addition to the polymer.

Vinyl Plastic Compositions and Method of Making the Same. No. 2,695,279. Samuel Kahn, Wollaston, Mass., and Wilbur B. Pings, Highland Park, Ill. (to Godfrey L. Cabot, Inc., Boston, Mass.).

The preparation of a plastic composition comprising a polyvinyl halide and a plasticizer.

Plasticized Polyvinyl Chloride Composition. No. 2,700,656. William S. Emerson and Raymond I. Longley, Jr., Dayton, O. (to Monsanto Chemical Co., St. Louis, Mo.).

The composition comprises a polymer of vinyl chloride containing a dispersed diester compound wherein the alkyl radicals contain 7-11 carbon atoms and the aromatic radicals contain 6-9 carbon atoms. Additionally, two other groups must consist of an alkyl and a methyl, ethyl, or hydrogen radical.

Polyurea Resins. No. 2,699,435. Robert W. Auten, Jenkintown, and Robert S. Yost, Oreland, Pa. (to Rohm & Haas Co., Philadelphia, Pa.).

An aqueous solution of epichlorhydrin and an alkylene polyamine is reacted until the resulting polyhydroxypolyalkylenepolyamine has a viscosity from J to Z_7 at 25° C. on the Gardner-Holdt scale. Urea heated to 100-200° C., is added in a ratio

from 0.5:1 to 1.8:1 of urea per -NH- group is reached in a 45% aqueous solution, and the resulting product has a viscosity of G-Z$_2$ at 25° C. on the Gardner-Holdt scale. Formaldehyde is added in a solution at a pH between 7 and 9.5.

Plasticized Polymer Latexes and Method of Making. No. 2,700,026. Carl L. Dilbert, St. Louis, Mich. (to Dow Chemical Co., Midland, Mich.).

An alkaline aqueous dispersion of a plasticized polymer comprises, by weight, 50-70 parts monovinyyl-mononuclear aromatic hydrocarbon, and 30-50 parts plasticizer which consists of about 85% by weight homopolymer of alpha-methyl styrene, 2-5 parts sodium alkylbenzene-sulfonate, and 2-5 parts octylphenyl monoether.

Modified Polyvinyl Acetal Compositions. No. 2,700,028. Charles H. Jarboe, Louisville, Ky. (to E. I. du Pont de Nemours & Co., Wilmington, Del.).

The composition consists of polyvinyl butyral and 0.05-5% of 2-imidazoline-2-thiol, based on the weight of the polyvinyl butyral.

Stabilization of Polystyrene with 2,4-Dinitrophenylhydrazine. No. 2,701,241. Ernest H. Wood, Westfield, N. J., and James R. Wilkinson, Milwaukee, Wis. (to Union Carbide & Carbon Corp., New York, N. Y.).

The composition comprises polystyrene and 0.01-15% 2,4-dinitrophenylhydrazine by weight.

Low Temperature Polymerization Process and Composition. No. 2,701,242. Michael Erchak, Jr., Morris Township, Morris County, Karl F. Koch, Madison, and Harry Knutson, Morristown, N. J. (to Allied Chemical & Dye Corp., New York, N. Y.).

A composition polymerizable at temperature from 0-35° C., comprises a monomer of which 50-100 mol % is either acrylonitrile, methyl acrylate, methyl methacrylate, and methyl vinyl ketone, with substantially all of the polymerizable ingredient being mono-ene monomer, and a catalyst of potassium permanganate and oxalic acid.

Epoxide Resins. No. 2,698,315. Sylvan Owen Greenlee, Racine, Wis. (to Devoe & Raynolds Co., Inc., Louisville, Ky.).

Diphenol is reacted with an excess of chlorhydrin in the presence of caustic alkali to produce a solid, water-insoluble resinous product.

Polymerization Process for Polymerizable Organic Compounds Containing the Group $CH_2{=}<$. No. 2,698,968. Henry P. Callahan, Fairfield, and Donald G. Jordan, Stamford, Conn. (to American Cyanamid Co., New York, N. Y.).

A mixture of acrylonitrile monomer and a monomeric compound selected from the group consisting of styrene and ring-substituted alkyl and halo styrenes, is heated to about 130 C., in a sealed tube of polyfluoride material. The tube is subjected to an external pressure sufficient to equal the total vapor pressure of the reacting material during heating, which is continued until the resulting copolymer is rigid enough at room temperature to retain its shape.

Bead Polymerization of Methyl Methacrylate. No. 2,701,245. William Lynn, Rochester, N. Y. (to Eastman Kodak Co., Rochester, N. Y.).

Discrete polymeric spherical beads, 1-20 microns in diameter, are formed from water-insoluble methyl methacrylate by agitating the monomer in water and in the presence of a dioctyl ester of sodium sulfosuccinic acid, and a polymerization catalyst. Agitation is stopped before polymerization occurs, so that the latter can take place in a quiescent state.

Modified Melamine-Formaldehyde Resin and Process of Preparing the Same. No. 2,697,086. Richard Lindenfelser, Darien, and Martha K. Kilthau, Cos Cob, Conn. (to American Cyanamid Co., New York, N. Y.).

Melamine, formaldehyde, and a polyvinyl butyral are heated at about 75° C. and a pH of 7-10-5, and refluxed in alcohol until the solution no longer crystallizes upon cooling to 0° C. The mole ratio of melamine to formaldehyde is between 1:1.5 and 1:4.5, and polyvinyl butyral comprises 20-40% of the total, by weight. The composition is suitable for laminates.

Process for Polymerizing Chlorotrifluoroethylene with Bis-Heptafluorobutyryl Peroxide. No. 2,700,662. Donald M. Young and Bruce Thompson, Charleston, W. Va. (to Union Carbide & Carbon Corp., New York, N. Y.).

Chlorotrifluoroethylene is reacted with a small amount of bis-heptafluorobutyryl peroxide within the temperature range of 0-50° C., to effect polymerization.

Equipment

Apparatus for Continuously Milling Plastics. No. 2,698,962. Herbert A. Swallow, North Branch, N. J. (to Union Carbide & Carbon Corp., New York, N. Y.).

Plastic material is continuously charged into the end portion of a closed chamber cylinder, which has substantially a figure-eight cross-section of intersecting cylinders. These cylinders rotate the material in opposite directions and at different speeds (one twice the speed of the other). The milled material is finally ejected by continuous axial force.

Electrical Element Mounting Jig. No. 2,699,133. George W. Ames, Cresskill and Harold W. Herrington, Upper Montclair, N. J. (to Bell Telephone Laboratories, Inc., New York, N. Y.).

A jig for mounting terminal equipped electrical elements and conductors in a thermoplastic support comprises a plurality of separable, open-ended rectangular boxes arranged end-to-end, the two opposite side walls of each box having registered slots extending inward to support the terminals and conductors. The other two opposite walls have slotted blocks which support the thermoplastic member.

Applicator for Applying a Plastics Coating to Glass and Other Filaments. No. 2,698,965. Adelbert C. Radtke, Oak Park, Ill. (to International Harvester Co., Chicago, Ill.).

The applicator comprises a fluid motor, a rotatably driven agitator member, and a tubular sleeve concentric with and spaced outwardly from the agitator, thus defining a tubular space for the fluid plastics which are heated and discharged through a die. Rods attached to longitudinal notches in the agitator rotate with it, and wipe the inner surface of the tubular concentric sleeve.

Machine for Making Molds. No. 2,698,976. Russell W. Taccone, North East Township, Erie County, Pa. (to Taccone Pneumatic Foundry Equipment Corp., North East, Pa.).

The molding machine consists of a mold box and support, an open cavity head, and a flexible obtruder secured to the head and forming a closed chamber. Air pressure controls the action of the obtruder which is larger in surface area than the mold box, thereby eliminating tension on compression of the molding material.

Plastic Extrusion Machine with Pressure Control Means. No. 2,698,964. Henning T. Tornberg, Ridgewood, N. J. (to Modern Plastic Machinery Corp., Lodi, N. J.).

The extruder consists in part of a cylinder having a discharge end; a conveyor screw positioned therein for axial rotation of the material toward the discharge end; a sleeve being keyed to the screw and turning with it; and a fixed bearing structure supporting the sleeve for rotary movement. A second sleeve slides axially about the rear of the first sleeve, and a shank extending axially rearward from the screw is in contact with the front surface of a blade spring which extends across the rear of the second sleeve. Spaced elements extend forward from a member which extends from the first sleeve, and contact the rear surface of the blade spring. On movement of the screw rearward in the cylinder, the blade spring becomes bowed and stressed, whereupon the second sleeve slides forward and controls the movement of the driving wheel. An arm, mounted in the path of the second sleeve, diminishes the wheel's speed after a predetermined amount of movement.

Molding Machine for Molding Plastic Articles. No. 2,699,574. Charles E. Gilbert, New York, N. Y. (to Gilbert Mfg. Co., Inc., Long Island City, N. Y.).

The machine has a plurality of molding mechanisms of predetermined design; each having a die for shaping the article, a feeding mechanism, and a mechanism for removing the molded articles in a semi-plastic state to another chamber where they are accurately reformed to final size and shape. Additional parts flash the article and discharge it from the machine. All operations are timed automatically.

Apparatus for Advancing and Plasticizing Plastic Compounds. No. 2,693,617. Edward W. Weitzel, Hickory, N. C. (to Western Electric Co., Inc., New York, N. Y.).

A new apparatus for simultaneously advancing and plasticizing molding materials, and extruding them as concentric coverings over cores.

Plastic Cutting Tool and Cutting Tip Therefor. No. 2,701,835. Nicholas Anton, Park Ridge, Ill.

The tool for thermally cutting material, such as thermoplastic tile blocks, comprises a casing with a hollow housing for holding a transformer, the secondary coil being a U-shaped metallic rod bent around the core to give a pair of vertically spaced leg elements. Aligned ends project forward from the housing, and the cutting implement, in the form of an electric resistance element, is attached to the secondary coil and has a pair of rounded leg elements joined in an apex. Tapering of the cutting element affords high electrical resistance.

Processing

Method and Apparatus for Producing Injection Molded Products. No. 2,698,460. Ivan J. Amo, North Plainfield, N. J. (to M & W Co., Inc., Rahway, N. J.).

Heated material is forced through a sprue into a pair of dies by pressure injection. A free control element is advanced through the sprue by the pressure discharge of the heated material through the injection nozzle. The formed product includes an integral sprue portion which is severed by actuating the free element.

Method of Forming Gate-Free Injection Molded Products. No. 2,698,464. James S. Wilson, Short Hills, N. J. (to M & W Co., Inc., Rahway, N. J.).

Plastic material is injection molded from a heated zone into a pair of movable dies through a sprue bore opening at adjacent edge portions of the cavities. A sprue removal element is placed in axial alignment with the sprue bore and actuated to trim the sprue from the products, the sprue then being returned for remelting The dies are separated, the products removed, and the process repeated.

Molten Plastic Extrusion Process. No. 2,698,463. Yeates Conwell, Greenville, and Warren F. Busse and Vincent P. Caracciolo, Wilmington, Del. (to E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.).

A normally solid polymer of polyethylene which contains 0.001-0.02% ethylene polymer stabilizer by weight is heated to 200-350° C., extruded, and drawn at a linear rate greater than that at which the polymer itself can be drawn at the same temperature. At least one dimension of the extruded material is reduced by drawing.

Vinyl Leather Products and Process of Producing Same. No. 2,700,630. James R. Bukey, Douglassville, Pa. (to Firestone Tire & Rubber Co., Akron, O.).

Web-material is coated with unconverted vinyl plastisol, pressed against a hot-calendered vinyl chloride sheet, and heated to gel the plastisol and convert it to a resilient bonding layer. Another process involves interposing a gelled plastisol between a calendered vinyl chloride resin and a textile fabric backing.

Method for the Manufacture of Plastic Articles Having Reflecting Surfaces Thereon. No. 2,699,402. Garson Meyer, Rochester, N. Y. (to Eastman Kodak Co., Rochester, N. Y.).

Plasticized cellulose acetate butyrate is molded to the desired shape; the total surface is sealed with an adherent layer of unreaformaldehyde resin; an adherent aluminum metal reflecting layer is vacuum coated over the urea; transparent adherent epoxide-urea formaldehyde covers the aluminum; and finally the article is coated with transparent silicone.

Method of Producing Fibers from Glass and Other Heat-Softenable Materials. No. 2,699,631. Charles J. Stalego, Newark, O. (to Owens-Corning Fiberglas Corp., Toledo, O.).

A combustible gaseous mixture is burned in a chamber with a restricted outlet through which the combustion products are discharged in the form of a hot, high velocity blast. This hot, compressed gas is confined by directing streams of air along opposite sides. Primary filaments of glass are fed into the confined area in a direction substantially normal to the movement of the blast.

Method of Providing Articles with a Plastic Coating. No. 2,700,631. William C. Ferguson, St. Louis, and Paul S. Sussenbach, Brentwood, Mo. (to Pressite Engineering Co., St. Louis, Mo.).

A flat, thin ribbon of thermoplastic material is heated, extruded, and wrapped helically around an elongated article with overlapping convolutions in the direction of its length.

Method for the Digestion of Cellulose-Bearing Material. No. 2,698,789. Walter E. Segl, Wilmington, Del. (to Hercules Powder Co., Wilmington, Del.).

Pressure-resistant cellulosic material is disintegrated and formed by continuously forming a compact of the material in a compression zone, and continuously extruding this compact from the compression zone in the form of an annular body which is disintegrated by expelling its fluid content.

Process Using Vinyl Hydroquinone Polymers. No. 2,700,029. Harold G. Cassidy, New Haven, Conn.

A synthetic organic polymer of ethylenically unsaturated monomeric material, which can be oxidized or reduced, is converted to either state and reacted with a solute. This effects a transfer of electrons with the polymer without substantial degradation. After separation the polymer is reconverted to the starting state.

Method and Apparatus for Shaping Plastic Interlayer for a Curved Laminated Windshield. No. 2,700,007. Brook J. Denison and William G. Smith, Tarentum, Pa. (to Pittsburgh Plate Glass Co., Pittsburgh, Pa.).

A plastic interlayer for a laminated windshield is preformed by applying a transverse band of color across the upper portion of a plastic sheet which is stretched and heated under tension to sag the central portion.

Process for Producing Shaped Articles from Mixtures of Polyamides. No. 2,700,966. Louis L. Stott, Reading, Pa., and Laurence R. B. Hervey, West Concord, Mass. (to The Polymer Corp., Reading, Pa.).

Finely divided synthetic linear polyamide material of high melting point is mixed with low melting point polyamide material, and compressed to a predetermined shape in a mold. The shaped material is then heated in the absence of oxygen to a temperature which will melt the second polyamide, whose amount should not exceed 70% by weight of the first polyamide.

Process of Preparing Paraffinic Anti-Corrosive Strip Material. No. 2,702,255. Jacques Jean Trachet, Ohain, Belgium.

A film of polyethylene having a molecular weight between 9-20,000 is immersed in molten paraffin of lower molecular weight to form an anti-corrosive coating.

Surface Treated Plastic Materials and Method for Producing Same. No. 2,702,255. Luther L. Yaeger, Madison, Wis. (to American Motors Corp., Fond du Lac, Wis.).

Solvent resistance can be imparted to polystyrene by spraying a composition of mixed cellulose ester (with an 8% acetyl content) which has been dissolved in a solvent consisting of nitroalkane and aliphatic alcohols; the solvent being removed at a relative humidity less than 60 percent.

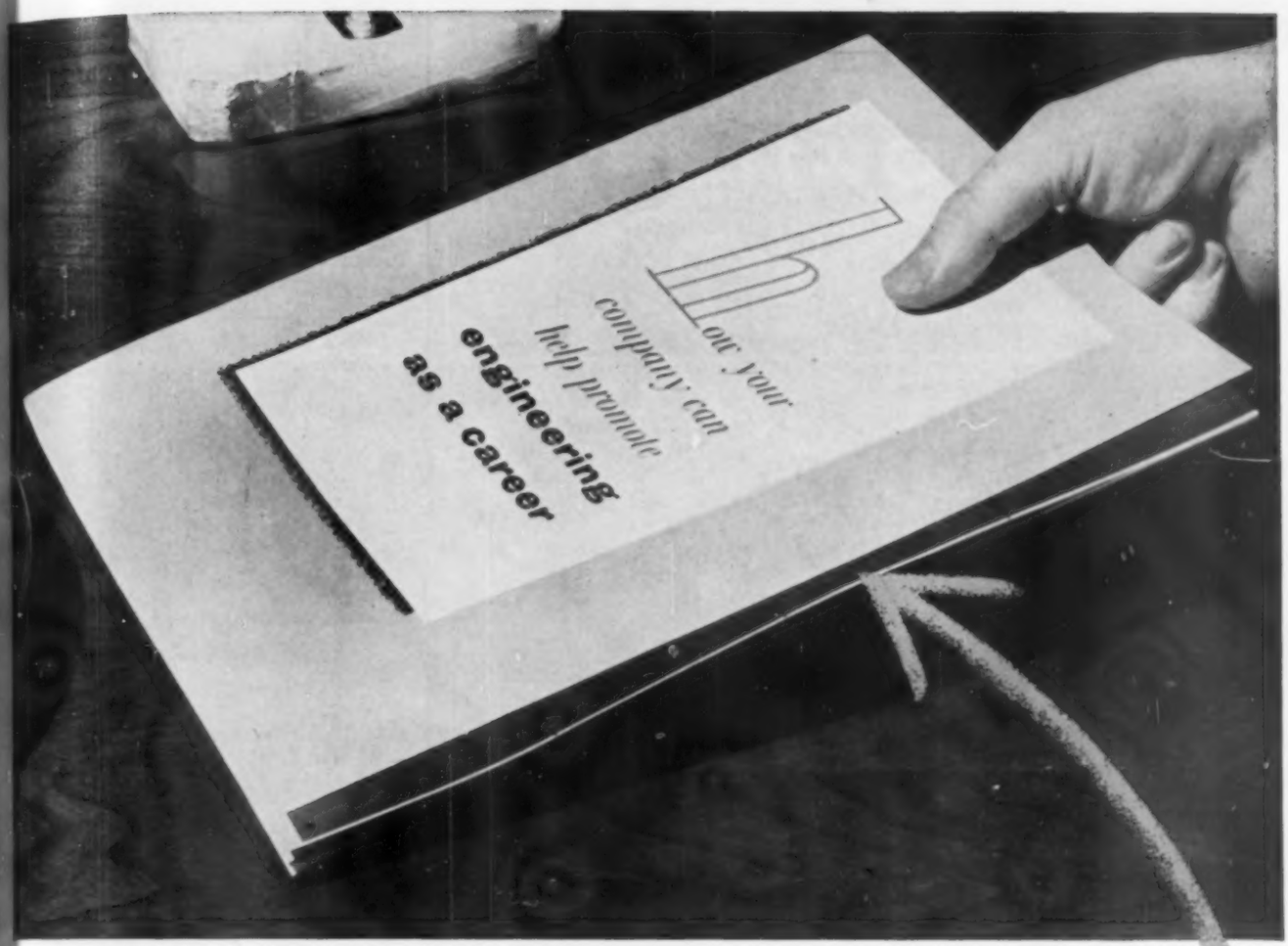
Application of Antistatic Materials to Dielectrics. No. 2,702,257. Carlyle Harmon, Longmeadow, Mass. (to Chicopee Mfg. Corp., Chicope Falls, Mass.).

Plasticized filaments, comprising the copolymer of vinylidene chloride and vinyl chloride or acrylonitrile, are coated with a uniform film of an antistatic agent.

Applications

Plastic Battery Case. No. 2,700,695. Herbert A. Gottschall, Clifton, N. J. (to the United States of America as represented by the Secretary of the Army).

The battery case and cell container has a dual wall of plastic material comprising a thicker wall of a synthetic high polymer with relatively high vapor pressure permeability, and a thinner wall of a synthetic high polymer having a relatively low vapor pressure permeability.



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CALENDAR of COMING EVENTS

March 22-26

Journées Internationales Des Plastiques. Paris, France.

March 30

Reinforced Plastics Group, SPE New York Section. McGinnis' Restaurant, Jamaica, N. Y.

April 4-5

AIEE Conference on Automation. Mayflower Hotel, Akron, Ohio.

April 12

Elastomer & Plastics Group, ACS Northeastern Section. M.I.T., Cambridge, Mass.

April 27

Reinforced Plastics Group, SPE New York Section. McGinnis' Restaurant, Jamaica, N. Y.

May 11

SPE Newark Section, Military Park Hotel, Newark, N. J.

May 16

SPE Southern Section. Atlanta, Georgia.

May 16-20

National Materials Handling Exposition, Chicago, Ill.

May 17

Elastomer & Plastics Group, ACS Northeastern Section. M.I.T., Cambridge, Mass.

May 18

SPE New York Section. Gotham Hotel, New York, N. Y.

May 19

Joint meeting, SPE Eastern New England Section and SPI Boston-Providence Chapter.

May 25

Reinforced Plastics Group, SPE New York Section. McGinnis' Restaurant, Jamaica, N. Y.

INDEX TO ADVERTISERS

MARCH, 1955

L. Albert & Son 118
Alpha Chemical Company 73
Baldwin-Lima-Hamilton Corporation ..... Inside Front Cover
Bolling and Son 118
Godfrey L. Cabot, Inc. Plastics Chemical Division 75
Continental Machinery Company, Inc. 70
Dow Corning Corporation 76
Goodyear Tire & Rubber Company, Inc. Chemical Division 69
Harchem Division, Wallace & Tiernan, Inc. 129
Hale and Kullgren, Inc. 78
Harwick Standard Chemical Co. ..... Inside Back Cover
Injection Molders Supply Co. 107
Metal & Thermit Corporation 73
Monsanto Chemical Company Plastics Division 80
Scott Testers, Inc. 73
R. T. Vanderbilt Co., Inc. 112
Van Vlaanderen Machine Co. ..... Back Cover

New Materials (Cont'd. from page 113)

Sub-Microscopoic Silicon Filler

Cab-o-sil, a sub-microscopic particul silica prepared in a hot gaseous envir ment (1100° C.) by vapor phase hydrol of a silicon compound, has been introduc by Godfrey L. Cabot, Inc., Boston, Ma Available in compressed and uncompre ed grades (the latter suitable for use plastics), Cab-o-sil's properties are lis as follows:

Silica content, %	99-99.7
Free moisture at 105° C., %	0.2-2.0
Ignition loss at 1000° C., %	0.2-1.0
CaO, MgO content, %	0.00
Fe_2O_3 content, %	0.004
Particle size range, microns	0.015-0.0
Surface area, nitrogen absorption, sq. meters/gm.	175-200
Specific gravity	2.1
Color	White
Refractive index	1.55
pH, 10% aqueous dispersion	4.5-6.0
Oil absorption, Gardner method, lbs. oil/100 lbs. pigment	150
Bulking value, gal./lb.	0.057
Apparent bulk density, lbs./cu.ft.	
Uncompressed grade	2.5-3.5
Compressed grade	6.0-6.5

Cab-o-sil is being used in the pla industry as a thickening and gelling a for plastigel formulations which are to be characterized by extreme stabi as an anti-blocking agent for cellophan and as thixotropic agent for vinyl dis sions and polyester-glass reinforced p tics. In the last mentioned usage, addition of 2-5% Cab-o-sil by weight vents polyester drainage from the g substrate in high points and vertical tions of the laminate, a difficulty o encountered in hand lay-up operations.

The use of Cab-o-sil is said to per a wider choice of plasticizers since flow properties can be suitably adjus Resulting mixtures are translucent ra than opaque, thus affording a wider ra of color choice.

New Products (Cont'd. from page 117)

Du Pont Breathable Vinyl

A new type "breathable" vinyl up stery material has been introduced by fabrics division, E. I. du Pont de Nem & Co., Inc., Wilmington, Del. This n addition to the Fabrilite line, na Castleton, reportedly offers maximum ing comfort by permitting the passage air through the vinyl coated surface the supporting knit fabric.

Designed by Russel Wright, Castlet abstract pattern suggests both leather fabric, but is intended to imitate neit It is available in 15 colors.